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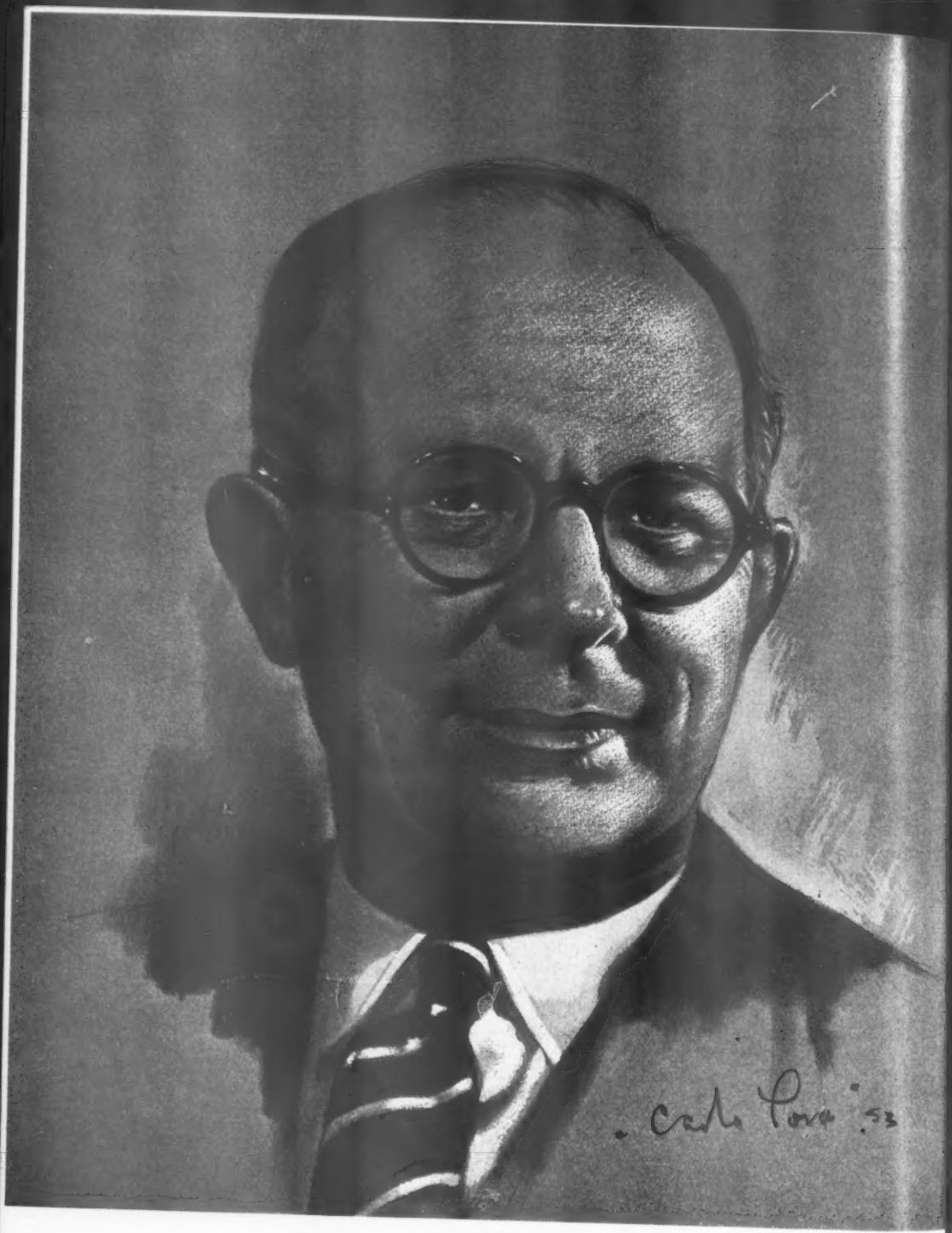
National Foundry College

Under modern manufacturing conditions, it is a truism that the casting cannot be better than the pattern used in its confection. So, too, the calibre of the personnel of the industry will be exactly reflected by the training received by its leaders. Just as a well-equipped patternshop is an essential for ensuring a high-grade production, so, too, the foundry training establishments must have plants appropriate for both teaching and research. It is thus of outstanding importance to the industry for the National Foundry College at Wolverhampton at long last to announce that, at least for the time being, it is adequately equipped for the training of foundry technicians to the high standard required.

Some people are inclined to measure the progress of the industry by the much higher properties required by current acceptance specifications for cast metals as compared with the earlier ones. We would prefer to point to the ever-closing gap between the quality of the output of the most reputable foundry concerns and the lesser type. The latter can no longer be ignored in the competitive market. This general improvement in quality is much due to the technical training recently available, first from the British Foundry School and more recently from the National Foundry College. Not only has this organization—for the latter is but a continuation of the former—directly provided industry with high-grade technical staff, but indirectly also through its graduates accepting teaching appointments in the various technical colleges. The influence of men trained at the College on their assistants when in industrial positions, is also of real benefit to the industry.

Much of the credit for the success of the National Foundry College, the extensions to which were formally opened yesterday by Sir Gilbert Flemming, K.C.B., is due to the pioneer and persistent efforts by Dr. J. G. Pearce. Realizing the benefits which were accruing to French industry through the work of the Paris Foundry High School, he adapted this intensive system of instruction to British requirements. Initially, it was hard work, but in time he succeeded in getting the enthusiastic support of Mr. P. H. Wilson, Mr. C. C. Booth, and many other prominent foundrymen. He was equally fortunate in the staffing of the College, headed by Mr. Bamford. An excellent record of successful students has been achieved, for it must be remembered that a college of this nature does not consist in buildings and equipment but a corporate body operating a curriculum carefully designed to combine instruction with character-building precepts. It is pleasing to record that to-day the whole industry is solidly behind the College, as has been shown by the generous support given to the appeal for funds and plant for the creation of this latest expansion. The foundry plant and supplies firms, too, have done all that was required of them and, if there be found any gaps during the running of the College, then we are sure that, on request to the appropriate section of the industry, they will be filled.



DR. J. G. PEARCE, O.B.E., M.Sc.
Director, British Cast Iron Research Association.

Leaders of the Industry

DR. J. G. PEARCE

JAMES G. PEARCE was awarded one of the first of the City scholarships to the University of Birmingham, from which he graduated in mechanical engineering, and later as M.Sc. Winning an 1851 Industrial Bursary, he took a college apprenticeship, which included foundry experience, at Metropolitan-Vickers, where he later assisted Sir Arthur Fleming in the establishment of the research and education department. During this time, he spent various periods in several continental countries, and, subsequently, some months in the United States.

In 1924, under the persuasive influence of the late Mr. Oliver Stubbs, he returned to his native city to become director of the British Cast Iron Research Association, the progress of which has since been his major interest. Three years old at that time, it was little more than a small office, but after some " uphill " years it has had a spectacular growth, from an income less than £5,000 a year to over £100,000, with capital assets well exceeding that sum in value, and a staff of nearly 100 housed at Bordesley Hall, Alvechurch, and at Glasgow. The Association now has an international reputation.

Arising from an interest in disseminating information, Dr. Pearce initiated the movement which led to the formation of the Association of Special Libraries and Information Bureaux (ASLIB), and was for several years its (first) chairman of Council. In 1935, he was responsible for initiating the establishment of the British Foundry School (the prototype of the national colleges), now the National Foundry College, of which he is vice-chairman of the Board of Governors and president of the association of its alumni, the Foundry Technical Group. During the war, the Ministry of Home Security nominated Dr. Pearce as chairman of the industry's Anti-Glare Committee, which initiated and supervised schemes involving a six-figure capital expenditure. He was also chairman of the Ironfoundry Industry Fuel Committee, which operated in conjunction with the Ministry of Fuel and Power. Later, he led a group of scientists to examine German wartime metallurgical developments. In 1951, he attended the first World Metallurgical Congress at Detroit.

He is a corporate member of the Institution of Mechanical Engineers and of the Institution of Electrical Engineers, a Fellow of the Institute of Physics and of the Institution of Metallurgists, a member of Council and double gold medallist of the Institute of British Foundrymen, and a past-president of the Birmingham branch. He is chairman of the main committee on cast iron of the British Standards Institution, and acts on many other committees.

In 1948 the honorary doctorate of the University of Aachen, the most outstanding university school of foundry science in the world, was conferred on him. In 1950 he was awarded the O.B.E. In 1935 he became a member of the Livery of the Worshipful Company of Founders (and a Freeman of the City of London), the first of a now considerable group actively associated with the industry, which owes much to the Worshipful Company for the Fellowships it has established for training and research.

The author of numerous papers in several languages, Dr. Pearce is in constant demand as a speaker. He finds recreation in travel and reading, and says he doesn't play golf but can't give it up.

Correspondence

JOHN WILKINSON

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—My attention has been drawn to the report of my recent talk to the Bilston Historical Society on the subject of John Wilkinson which appeared in your issue of January 21, p. 76.

I wish to say that I did *not* "categorically" state "that the first iron boat was launched at Bradley, Staffs, and not, as has sometimes been claimed, on the Severn, in Shropshire". I made no such statement. I merely said that John Wilkinson launched the first iron boat on the Severn (in Shropshire) in 1787, probably from Willey Wharf on the Broseley side of the river. Your correspondent may possibly have mistaken "Broseley" for "Bradley".—Yours, etc.,

W. H. CHALONER.
Senior lecturer in modern economic history.
University of Manchester, January 29, 1954.

Forty Years Ago

In the FOUNDRY TRADE JOURNAL for February, 1914, the Editor made a strong appeal for the simplification and reduction in numbers of the various specifications for non-ferrous casting alloys. The issue also contained an excellent paper by R. R. McGowan on stucco patterns, which carried a table for the calculation of camber when making channel sections. There was recorded a Home Office report on "Accidents in Iron-foundries", most of the recommendations of which have since become law. One feature has not been followed up, that is, the unfavourable report of the Chief Inspector on the use of iron floor plates near the cupola as being a prolific cause of metal splashing and burns. The trade union view was presented, but there being no employers' association, the views of the foundry owners were not available. Amongst new companies registered appears the name of Blackett, Hutton & Company, Limited.

Two Eastern Tea Kettles

By Dr. J. G. Pearce, O.B.E.

Cast-iron tea kettles of the type illustrated have been used in tea-making in the Far East from the earliest times. In ancient China, tea was prepared either by pouring hot water on powdered leaves in china bowls, or by heating the water and the leaves together in these kettles. Later the kettles were used only for boiling the water, the tea being made in a separate pot in the way common to-day.

The kettles shown were photographed by Mr. L. J. Stewardson, of the British Cast Iron Research Association. The larger one on the left has a body of cast iron, with a lid of rather heavy bronze bearing an oriental inscription on the underside. It is understood that the inscription is susceptible of more than one translation, in either Japanese or Chinese, but it is of no special significance. The handle is probably of wrought iron and has an ornamental silver inlay. The dragon design on this piece is heavily undercut, and the whole an excellent example of craftsmanship. The flange at the base is designed to rest on a portable charcoal heater. Such works may go back to the eighth century. This piece was acquired in London by Mr. J. W. Butler, secretary of the Council of Iron Foundry Associations, and presented to the B.C.I.R.A. in October, 1953.

The vessel on the right is of similar character, that is, a cast-iron body and wrought-iron handle, but lacks a lid, and the handle is not inlaid. It bears on one side an oriental design of a formalized landscape and on the other a figure resembling a Japanese samurai or feudal warrior. It was presented to the writer by Mr. J. J. van der Wal, of The Hague, in November, 1953. Both pieces have been exhibited at the Tea Centre, in London (which organization has supplied some of the information given here), with four other such pots.

• The writer would appreciate any information which would assist in determining the probable age and whether these pieces are in fact Chinese or Japanese.

CROMPTON PARKINSON, LIMITED, announce that they are shortly putting on the market two new ranges of Crompton fluorescent tubes:—(1) a new "Warm White" and (2) a de-luxe "Warm White." For these, over 10 per cent. more light than was previously attainable is claimed.

THE NATIONAL RESEARCH CORPORATION of Cambridge, Massachusetts, announces that the first non-exclusive license agreement covering the N.R.C. titanium shape casting process has been granted to the Titanium Casting Corporation, division of Howard Foundry Company, Chicago, Illinois.

National Foundry College

New and Enlarged Premises opened in Wolverhampton

The National Foundry College, a post-war continuation of the British Foundry School, opened for its first session in January, 1948, within the precinct of the Wolverhampton and Staffordshire Technical College. The facilities which were made available there were of a temporary nature and an appeal was launched (in 1953) for funds and equipment for providing more-or-less self-contained premises for the Foundry College. This appeal, supported alike by the education authorities (who provided the land and buildings) and the foundry industry generally, has resulted in the re-housing and re-equipping described in what follows. No fewer than seven foundry organizations and 56 individual firms sent donations of money and plant for the foundry. It is intended to record these gifts on a plaque in the entrance hall.

New premises of the National Foundry College at Wolverhampton were opened on Wednesday of this week by Sir Gilbert Flemming, K.C.B., Permanent Secretary to the Ministry of Education. The premises have cost approximately £133,000 and consist of a three-storey building and basement situated in Stafford Street, Wolverhampton. The facilities include the following:—two project rooms which are also to be used as lecture theatres; a laboratory for metallography and a dark room for photographic work in this field; a heat-treatment laboratory and one for metallurgical analysis; an engineering workshop; a research laboratory, and others, respectively, for routine analytical work and for sand control. A library, an X-ray room (complete with dark room) and a very well equipped experimental foundry complete the schedule (see Fig. 1).

Many items of special interest are embodied; for example, the lecture theatres are comprehensively equipped with the usual visual aids to lecturing, including film-strip projectors, lantern-slide projectors, and ciné projectors, the latter being capable of taking both sound and silent films. The students' desks are worthy of note since they have been designed by a member of the College staff to serve both as desks and drawing benches. These are shown in Fig. 2.

Equipment Installed

The metallography section contains a wide range of high-quality equipment, including two Vickers projection microscopes, and a number of bench microscopes. Some of the latter are of the stereoscopic and binocular types. The examination of metallurgical defects in cast material is thereby facilitated. The problem of storage of metallurgical specimens is always difficult in colleges, where a number of students are examining various alloys and to solve it two, specially-designed cabinets have been made, which afford a very convenient method of cross-referenced safe-keeping for both micro- and macro-specimens. A linisher, several independently operated polishing wheels, and a well-designed hand-preparation section allow the specimens to be prepared easily. In addition, one automatic polishing machine is provided. A Vickers diamond-pyramid hardness-testing machine is available.

The heat-treatment laboratory is of a very comprehensive character, and is fitted mainly with electrically-heated furnaces, all of which are pyrometrically governed and connected to a central control panel. Castings in a number of heat-treatable ferrous and non-ferrous alloys can be processed in this laboratory.

A good engineering workshop is installed, containing a large lathe, a " universal " milling machine, a mechanical hack-saw and large and small drilling machines. These facilities are intended for sampling and for the preparation of test-pieces for examination (see Fig. 3). A small laboratory is provided for research work.

Technical-control facilities are excellent, since two small laboratories adjacent to the main foundry building are equipped for routine analytical work and for sand control. A library is provided on the ground floor and a wide coverage is given of foundry, metallurgical and engineering textbooks and periodicals. A notable feature is the provision of a 250 k.v. X-ray set in the basement of the building. This unit is powerful enough to allow the examination even of ferrous alloys cast in reasonable thicknesses. A supersonic flaw-detector is also provided.

Foundry

The foundry is naturally of great interest, since it is the only installation of its kind in the Commonwealth designed to facilitate the teaching of foundry techniques on an experimental basis. The floor area measures 66 by 35 ft. and contains the following equipment:—a small cupola, lined to 12 in. dia.; two lift-out gas-fired crucible furnaces; a " rocking-arc " furnace; a high-frequency generating set, capable of operating a fixed furnace and also lift-coil unit.

The range of moulding machines installed is comprehensive, and units of standard size have been chosen. Both cartridge-type and floor-type core-blowing units are available. Sand preparation is carried out by means of a roller mill, and a "Royer" unit. An oil-sand mixer is also installed. A sand pit for jobbing work is built into the floor. Sand supply to moulding machines is effected by means of a number of portable hoppers of the shovel-out type. These are mounted on stillages and can readily be transported to the appropriate moulding machine. Normal shot-blasting and fettling equipment is installed. It is interesting to note that a complete unit for the pressure testing of a casting has been provided.

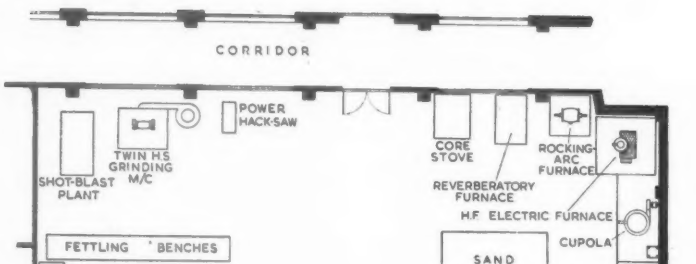


FIG. 1.—*Plan of the foundry, showing the disposition of the various items of plant. Not included are moveable items, such as cartridge-type coreblowers; die-casting machine, etc.*

FIG. 2.—*View of one of the lecture rooms, showing, particularly, the dual-purpose desk and drawing benches designed by the College staff.*

FIG. 3.—*Engineering workshop of the National Foundry College where a variety of machines is available for cutting-up castings for examination and for the preparation of test specimens.*

Founders will appreciate the necessity for students to have means for sectioning castings as soon as possible after production, and a unique feature in this direction is the provision of a 50-ton hydraulic press which enables all castings to be rapidly fractured without the necessity for prior cleaning or fettling. A geared hand-operated Durville casting table is installed, and a vertical-axis centrifugal casting machine is also available.

A small, yet very efficient, pressure die-casting machine adds significantly to the scope of work which can be carried out in the College foundry. Handling presents no problem since a portable jib crane and adequate lengths of portable roller conveyor are available.

Separate provision is made for patternmaking, and the new shop for this purpose contains a range of the accepted equipment used in this field. One interesting feature is the incorporation of a small pattern miller of Swedish design, which is extremely useful for the small work which will normally be carried out. It will be appreciated that the larger and more expensive types of miller which are standard in the industry are not normally suitable for technical college and similar work. Some idea of the layout of the four floors of the new College is given by Fig. 4.

KEY TO FIG. 4

First Floor: (1) Staff room; (2) part I diploma room; (3) part II diploma room; (4) and (5) cloakrooms. *Upper Ground Floor*: (6) Research laboratory; (7) dark room; (8) projection-microscope room; (9) metallographic laboratory; (10) preparation room; (11) polishing room; (12) heat-treatment laboratory; (13) storeroom; (14) engineering workshop; (15) staff cloakroom. *Ground Floor*: (16) Foundry (see Fig. 1); (17) principal's office; (18) library; (19) staff room; (20) office; (21) sand laboratory; (22) routine analytical laboratory. *Basement and Foundation Plan*: (23) storeroom; (24) X-ray room; (25) X-ray control room; (26) blueprint room; (27) dark room; (28) photography demonstration room.

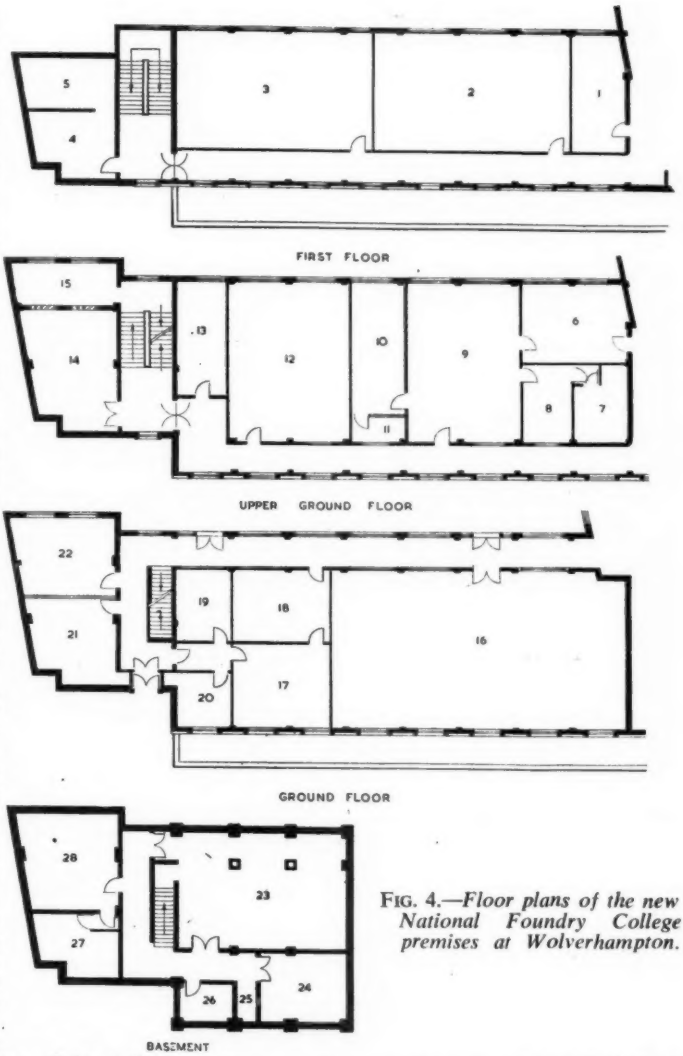


FIG. 4.—*Floor plans of the new National Foundry College premises at Wolverhampton.*

Appreciation

The response by industry to the appeal for funds made by the Board of Governors of the College has been extremely encouraging. It may be truthfully said that while the County and Borough educational authorities with the Ministry of Education have provided the accommodation and equipment for the rest of the Foundry College, the industry has furnished the whole of the plant and equipment of the foundry itself. The ways in which this material has been donated are many and various—some in cash and some in kind, with equipment and supplies manufacturers well to the fore—so it is impossible to make individual acknowledgment, but the director and Board of Governors of the College wish to make public their appreciation of all the help accorded.

There is no doubt that the new premises of the National Foundry College will contribute much to the overall efficiency of founding in the future, by providing a cadre of very high quality technical and administrative staff. Of significant proportions already is the contribution being made by past students of the College towards the staffing of the various technical colleges throughout the country which include the teaching of foundry practice in their curricula.

THE DEPARTMENT OF APPLIED CHEMISTRY of the Northampton Polytechnic, St. John Street, London, E.C.1, is organizing a course of lectures on "Corrosion and Packaging" on Wednesday evenings, commencing March 10 at 7 p.m. The lecturers include Dr. W. H. J. Vernon, Mr. J. J. Ferriggi, Dr. D. Clayton, Mr. D. J. Evans, and Mr. F. A. Paine.

DARALUM CASTINGS, LIMITED, of Longfield Road, Darlington, have acquired the exclusive rights from the Frontier Bronze Company, Niagara Falls, U.S.A., for the manufacture and use of a patented [627,968] zinc/magnesium/chromium/titanium/aluminium alloy. In ingot form it is to be manufactured by John E. Moore, Limited, of Yeadon, Yorks. The minimum mechanical properties are 16 tons per sq. in. maximum stress; 13 tons per sq. in. yield point; 5 per cent. elongation and 75 Brinell hardness. The natural aging period is 21 days, but this can be artificially effected by holding at 180 deg. for a short period. Details of other properties are available by writing to Darlington.

Moulders Refuse to Pay Fines

A large number of moulders (some reports say more than 200) at three Bonnybridge foundries have so far refused to pay a £2 fine imposed by their union. As already announced in the JOURNAL, they were fined for failing to take part in the nation-wide one-day strike on December 2. Two weeks before the stoppage these men had come out on a one-day strike of moulders only on instructions from Falkirk area union officials. When the national strike was called, the majority refused to come out again. Many say, "We don't want to pay the £2, but we suppose we will have to eventually if we want to hold our jobs." Others say they just won't pay. "We'll leave the trade union rather than pay," some add. This is typical of a revolt against union dictatorship, which is growing in strength.

The rules of one union, for instance, give power to the executive Council to order a strike anywhere, at any time, without taking a vote among the rank and file. And they can punish, by fine or expulsion, any who disobey. The executive Council have power to try and to punish each case without consulting the member's branch or district committee. A member can be fined £20 for failing to strike—another £20 for publicly criticizing or booing his officials—another £20 for going to the management to express his regret at being forced to strike—another £20 for telling the Press or any outsider what happened at the meeting. He can be expelled from the union and virtually deprived of following his trade without the option of a fine. Altogether, an extraordinary state of affairs, one might think.

Resentment among some of the rank and file of the E.T.U., for example, has reached the stage where they may obey orders, but they no longer submit quietly. There is a widespread feeling that this revolt would be stronger still if a secret ballot were insisted on.

Businessmen Behind the "Curtain"

The hopes of the British businessmen who left on a visit to Moscow on Tuesday week are high. According to Mr. J. B. Scott, sales director of Crompton Parkinson, Limited, who is leading the party, Russian visas for the visit were granted to those companies engaged in trades with which the Russians felt they could do business. The party hopes, says Mr. Scott, that the trip will result in Anglo-Soviet trade running into many millions of pounds.

While it is expected that there is little chance of much trade in British consumer goods, those engaged in shipbuilding and heavy engineering, for example, present a formidable array. Twenty-six firms are represented, of which seven do not wish their names to be published. The others include:— Wm. Asquith, Limited; Blaw-Knox, Limited; the Brush Group; Crompton Parkinson, Limited; Davy & United Engineering, Limited; Enfield Cables, Limited; Johnson & Phillips, Limited; Lancashire Dynamo & Crypto, Limited; Lobnitz & Company, Limited; Thomas Robinson & Sons, Limited; J. Sagar & Company, Limited; J. Stone & Company (Holdings), Limited; Ruston & Hornsby, Limited, and U.D. Engineering Company, Limited.

The party, which will pay its own expenses, will spend 14 days in Moscow and each member will conduct his own negotiations with the respective Russian departments. The Board of Trade and Ministry of Supply have confirmed that the goods which the group will offer will not be barred for strategic reasons.

Retired After 52 Years

After nearly 52 years' unbroken service with the company, Mr. Oliver Thomas, manager of the materials-handling department of the Fraser & Chalmers Engineering Works of the General Electric Company, Limited, has retired. Mr. Thomas joined Fraser & Chalmers, Limited, as the company was then known, in 1902, and, after a period in the machine-shops and other departments was appointed manager of the estimating department of the materials-handling department. He then became associated with Mr. R. K. Stockwell, the European manager of Robins, Inc., of the U.S.A. and under his guidance the two companies pioneered the development of nearly all modern materials-handling equipment.

During the early 1920's, when there was a dearth of orders for materials-handling equipment, Mr. Thomas undertook the sales representation for this product under the guidance of Mr. W. S. Edwards, who was then manager of the department. In 1940, on the death of Mr. Edwards, he took over the general management of the section. At the end of the war Mr. Thomas was a member of the allied commission in occupied territories which investigated German materials-handling and treatment plants. He is succeeded by Mr. B. S. Pelton.

Selling in South America

South America is often quoted as an area of the world to which Britain could export more. The view of Mr. Heathcoat Amory, Minister of State at the Board of Trade, who has just returned from a visit to Argentina, Brazil, and Uraguay, is that if there is to be any expansion in trade in this market it will be in capital goods as opposed to consumer goods. Mr. Heathcoat Amory has declared that he is not hopeful about an immediate increase in trade, but looking farther ahead he thinks the prospects are better. The governments of all the three countries he visited were anxious to develop their own industries, and this would bring about a change in the pattern of trade. The outlook for sales of British-made capital goods was certainly better than that for consumer goods.

The business would not be easy, he continued. There would be intense competition, especially from German exporters. The Germans were displaying their usual vigour, tenacity, and patience in obtaining orders in these markets and equally vigorous salesmanship was needed from British exporters.

B.I.S.R.A. "3-D" Films

The high-speed stereoscopic films shown by B.I.S.R.A. at the seventh international festival of science films in London last September aroused such interest that the scientists responsible were invited to present them at an international festival of industrial films organized in Belgium by the *Cinématheque de Belgique*. The films show in slow motion and three dimensions the interior of a blast-furnace seen through a tuyere. Using apparatus designed and built in B.I.S.R.A.'s physics laboratories, Mr. Charles Burns showed them with explanatory lectures in French at three meetings of the Festival (in Brussels, Liège and Charleroi) in January. They evoked great interest and some well-informed discussion. After this, Mr. Burns was able to give an impromptu demonstration at the Royal Dutch blast-furnaces and iron works in Ijmuiden, thanks to the interest and efforts of the director of the research department and the director of the Netherlands Technical Film Centre.

Institute Elects New Members

At the Council meeting of the Institute of British Foundrymen held at Derby on January 16, the following were admitted to membership of the Institute in the grades indicated:—

As Members:

F. C. Baker (J. Hobkirk Sons & Company, Limited, Bedford); W. G. Barczyk (Busmetal Limited, Bulawayo); R. E. Berry (Manganese Bronze & Brass Company, Limited, Ipswich); F. G. Burgess (George Kent, Limited, Luton); D. Chalder (Leicester Lovell & Company, Limited, Southampton); H. Charmock (Kitchen & Wade, Limited, Halifax); L. C. Cox (Evans & Company, Radstock); F. Crankshaw (K. & L. Steelfounders & Engineers, Limited, Letchworth); W. D. Dorrell (W. Stansby & Company, Limited, London); D. L. Eide (a/s Wingaards Ovnstoperi & Fabrik, Bergen, Norway); N. W. Homer (Anderson & Homer, Limited, Walsall); J. G. Hughes (Hepworth & Grandage, Limited, Bradford); T. Hurst (Darlington Forge, Limited, Darlington); G. Jowett (Holroyd & Hall, Limited, Bradford); J. H. Lomas (Sheepbridge Equipment Limited, Chesterfield); J. W. Myers (Vickers Armstrongs, Limited, Newcastle-upon-Tyne); F. W. Potts (Cochrane's (Middlesbro') Limited); J. Prendergast (United States Foreign Operations, Rome); J. F. Price (J.F.P. Diecasting & Engineering, Christchurch); L. C. Pugh (R. A. Lister & Company, Limited, Dursley); E. Shepherd (Holroyd & Hall, Limited); W. V. Sheppard (Southampton Bronze Foundry); J. E. Smethurst (Jas. Smethurst & Son, Limited, Warrington); A. G. Thomas (Mason & Burns, Limited, Walsall); S. D. Joshi* (Narayan Bhuwan, Dr. Bedekars Hospital, Ghantali, Nr. Bombay); B. Longstaffe* (Henry Wallwork & Company, Limited, Manchester); W. G. Murray* (Borough Polytechnic, London); C. M. G. Wallwork* (Henry Wallwork & Company, Limited); E. Wright (Ernest Wright Enterprise Foundry, Sheffield).

As Associate Members:

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Mixing Politics and Business

When he leaves London on February 17 for an extensive tour of the Near East, Mr. R. R. Stokes, M.P., will commence a long programme of political and business activities. Mr. Stokes, who was Lord Privy Seal in the Labour Government, will include in his itinerary Beirut, Bagdad, Addis Ababa, Nairobi, Mombasa, Entebbe, Khartoum, Cairo, and Rome, and on his semi-official goodwill tour he will have the approval of Mr. Attlee, leader of his Party. Among the important personages he will visit are the heads of the Lebanese, Iraqi, and Egyptian governments.

In his capacity as managing director of Ransomes & Rapier, Limited, Ipswich, and Cochran & Company (Annan), Limited, he will make many calls in furtherance of the exchange of trade between the United Kingdom and the countries in the Near East. Both companies have an impressive record of successful trading in the Near East and have for many years exported to various parts of the world the major part of their production of heavy capital engineering goods, such as excavators, mobile cranes, boilers, railway plant, and water-control gates for irrigation, river control, and hydro-electric power schemes. The Ipswich firm, in the face of keen Continental competition, recently secured the contract for supplying water-control gates and equipment for the new Wadi Tharthar project 100 miles north of Bagdad, containing some 4,000 tons of iron and steel work.

High Authority's Investment Policy

The Common Assembly of the European Coal and Steel Community, at the end of its two-day meeting at Strasbourg, gave unanimous approval to the High Authority's proposed investment policy. Before doing so, however, it received M. Monnet's agreement to its requests that the community's development should take account of expansion in third countries and that the assembly's Investment Committee should be kept fully informed of the High Authority's activities. This committee is now to receive detailed reports every two months, beginning in March.

In his speech M. Monnet examined possible future activities of the community. He referred briefly to the proposals sent to the United Kingdom for a closer association, but gave no hint of their contents or British reaction to them.

Importance of Reducing Costs

Reviewing the investment proposals, he emphasized the importance of reducing costs if the community's industries were to be competitive with third countries. This involved not only investment in the raw material industries to lower raw material costs, but also the rationalization of the coal and steel industries and the closing of uneconomic units. Realizing the effect these proposals would have on workers in the community and the possibility of unemployment, the High Authority was creating a fund of $7,000,000 for re-adaptation of workers. On the financing of investment M. Monnet announced that, by June, 1954, the High Authority would have a fund of $35,000,000 raised from the production levy, available for loans and the guaranteeing of loans. He gave examples of current rates of interest on short and long-term borrowings and promised that the High Authority loans would carry a substantially lower rate of interest. Negotiations were in progress for a loan or loans from the United States.

Throughout his speech he emphasized the great importance of co-operation between the various national governments and the High Authority if the plan were to succeed.

The assembly approved the proposal of £1,500,000 for its budget for 1954-55, but was unable to accede to the request of the Council of Europe that its Consultative Assembly should hold joint meetings with the Common Assembly. It was agreed, however, that joint meetings could be held when the Common Assembly was not required to approve High Authority action or take any votes.

The new price rules for the Common Market, which come into effect on February 1, have not been favourably received in either France or Germany. The Germans especially consider that they will be difficult to work. Another price problem raised with the High Authority is the granting of rebates to steel-consuming industries whose products are to be exported. Exporters of these goods declare that they are finding it difficult to compete with goods of countries outside the community, and the High Authority has decided to refer this complex and difficult problem to the Council of Ministers and the Consultative Committee.

THE SALVAGE of iron ore from three ships sunk in Narvik harbour in 1940 starts in April. They are the Swedish Torne, the British Riverton, and the German Neuenfels, and they carry a total of 20,000 tons of ore valued at 1,000,000 kroner.

Heat-Treatment of Spheroidal-graphite Cast Iron*

By Marcel Ballay, Raymond Chavey and Jacques Grilliat

(*Continued from page 97*)

Hardening by Means of Quenching after Localized Heating

The designer often needs components able to resist shocks, *i.e.*, the components have to be relatively soft, but hard in certain places in order to resist wear or sudden stress without permanent deformation. Case-hardening of mild steels followed by quenching, and quenching after partial heating of steels of higher carbon content, are measures often adopted. Shortly after S.-g. irons first came into use, the same problem was encountered in their use and immediately solutions were found. An examination recently conducted on the martensitic quenching of these irons showed that they lend themselves readily to local hardening. Nevertheless, the factor of austenitizing time must be closely examined here, for the period of heating is very short when medium or high-frequency current or the oxy-acetylene torch is used for heating. It will be shown that ferritic irons, interesting as they are on account of their ductility and impact strength, are less suitable for local hardening than the pearlitic or ferritic/pearlitic irons.

Several writers have referred to this type of hardening, but the information which they provide is meagre and so far as the Authors are aware no systematic study of the subject has been made. (Mention should be made, however, of a short note by Takao Takase[10] who indicates that pearlitic S.-g. iron hardens more easily than ferritic malleable iron, adding that pearlitic malleable iron can easily be hardened by induction heating.) For this reason some tests were made which are briefly summarized. They comprised quenching after local heating in a lead bath, by medium frequency current or flame. Table VIII gives the properties of the irons tested, particularly the contents of Si, Mn, Ni and Mo. The other elements were present in the amounts usual in S.-g. irons, *viz.*: T.C., 3.1 to 3.5; P, about 0.05; S, 0.01 or less; and Mg, 0.08 to 0.12 per cent.

Partial Quenching (Hardening) by Heating in the Lead Bath

Although this method of heating before quenching is not very much used in actual practice, it has a certain interest because it is easier to determine the temperature reached than when use is made of heating by flame or current.

Round bars, 12 mm. in diameter and about 80 mm. long, of two irons (compositions given in Table IX), one in the as-cast and pearlitic, the other in the annealed ferritic condition, were immersed over 30 mm. of their length in a lead bath heated to 850 deg. C. and held there for 1½ and 6 minutes, finally being quenched in oil. Preliminary tests had shown that it took 90 sec. for them to rise from 25 to 850 deg. C.

Table X gives the hardnesses obtained on the cylindrical surfaces of the bars at 10, 15 and 22 mm. from the end immersed in the lead. It will be observed that the pearlitic iron hardens greatly whilst

*Paper presented to the Paris International Foundry Congress.

TABLE VIII.

Iron.	Si.	Mn.	Ni.	Mo.	State before partial heating.	Microstructure of the matrix before partial heating.	Brinell Hardness. As cast.	Brinell Hardness. Before partial heating.
2430	2.22	0.45	6.31		Reheated 30 min. at 625 deg.	Sorbite	460	335
2450	2.65	0.29	2.00		As cast	Pearlite	286	286
2455	2.70	0.70	3.00	0.70	Reheated 30 min. at 625 deg.	Sorbite + a little carbide	345	342
2458	2.80	1.25	3.01	0.70	Ditto	Ditto	414	347
2460A	1.47	0.76	4.06		Ditto	Sorbite	314	292
2460B	1.29	0.73	5.39		Ditto	Ditto	486	327
2464A	2.34	1.41	2.82		As cast	Pearlite	290	290
2464B	2.34	1.83	2.98		Ditto	Sorbite	330	330
2465	2.36	0.81	1.44		Reheated 7 hours at 700 deg.	Pearlite + a little ferrite	309	296
2504	3.32	1.39	4.50		Reheated 30 min. at 625 deg.	Sorbite	450	308
2527	2.99	0.24	1.89		As cast	Pearlite + 25 per cent. ferrite	265	265
2527R	2.99	0.24	1.89		Annealed	Ferrite	265	180
2635*	2.27	0.79	1.84		As cast	Pearlite + 15 per cent. ferrite	292	292
2674F	2.49	0.26	1.65		Ditto	Pearlite + 30 per cent. ferrite	277	277
2674G	2.49	0.26	1.65		Annealed	Ferrite	—	184
2679Q	3.06	1.01	3.12	0.45	Reheat for 1 hour at 625 deg.	Sorbite	—	347

* T.C. 3.87 per cent.

TABLE IX.

Iron.	T.C.	Si	Mn	Ni	P	Mg	Condition before quenching.	Structure.	Brinell Hardness.
2566	3.46	2.32	0.40	0.98	0.07	0.13	As cast	Pearlitic	272
2634	3.53	2.76	0.21	2.00	0.025	0.13	Annealed	Ferritic	190

TABLE X.

Iron.	Time for rise from 25 to 850 deg. C., min.	Holding time at 850 deg. C. min.	Brinell Hardness after oil-quenching (tungsten carbide indenter 5 mm., under 750 kg.).		
			At 10 mm.	At 15 mm.	At 22 mm.
2566	90	90	653	621	611
2634	90	90	269	269	224
2566	90	360	642	642	611
2634	90	360	272	272	266

the ferritic iron, even after having been held for 6 minutes at 850 deg. C., hardened but slightly. The tests were not continued, but it is probable that at higher temperatures, such as 950 or 1,000 deg. C., it might be possible to harden ferritic iron by quenching.

Heating by Means of Medium-Frequency Current

The tests were made with a current of 8,000 cycles per second, produced by a rotary generator (thanks are due to the *Société Générale d'Applications Electrothermiques* and, in particular, to Mr. Paul, for the facilities accorded for making these tests). The heat was applied to the cylindrical part of specimens 50 mm. in diameter and 15 mm. long. Heating was followed at once by spraying with water, or cooling was effected in still air and by conduction.

Table XI gives the Rockwell C hardness (40 kg.) at the surface, the Vickers hardness (30 kg.) and the depth of the quench area, measured in two different ways:—(*a*) by examination using the Vickers pyramid, the value given being the depth in mm. for which the Vickers hardness is above 500; (*b*) by macrographic etching. It will be seen that the two methods do not agree; the first appears more interesting, however, since the macrographic appearance gives no direct indication regarding hardness.

The heating conditions were varied by changing the power used—expressed in kw. per sq. cm. of heated surface—and by variation in duration of heating time. With 2.35 kw. per sq. cm. it is possible to heat for more than two sec. without causing surface fusion.

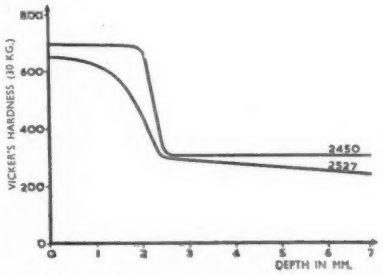


FIG. 5.—*Vickers hardness of pearlitic and ferritic/pearlitic irons hardened by medium-frequency current (heating).*

Fig. 5 relates to a pearlitic iron (2450) and a ferritic/pearlitic iron (2527 with 25 per cent. ferrite) containing no alloy elements other than those necessary for introducing the magnesium. The Vickers hardness at the surface is more than 600 (Fig. 10). It will be observed that the pearlitic iron hardens more deeply (by quenching) than does the ferritic/pearlitic iron. Iron 2572R, which is completely ferritic, hardens very little: the periods of heating are not sufficient for carbon to be dissolved in the austenite.

Fig. 6 relates to self-hardening irons. It can be seen that they harden markedly by just being cooled in air, the surface hardnesses being above 550 Vickers. For a heating period of two sec. iron

TABLE XI.

Iron No.	Conditions of heating.		Method of cooling.	Rockwell Hardness C at the surface under 40 kg.	Vickers hardness at the surface under 30 kg.	Depth of quench in mm.	
	Power in k.w. per sq. cm. of quenched surface.	Duration of heating in seconds.				For H. Vickers 500.	Measured by macrograph.
2450	2·35	2·0	Water	59.5	709	0.95	1.30
,,	1·52	3·0	,,	59	693	2.25	2.20
2527	2·35	2·0	,,	56	608	1.05	1.30
,,	1·52	3·0	,,	57	639	1.57	2.10
2527R	2·35	2·0	,,	20.5	234	—	—
,,	1·52	4·0	,,	42	360	—	—
2430	2·35	2·0	Air	54	544	1.80	2.40
,,	2·35	1·8	,,	52	556	0.60	0.60
,,	2·35	2·2	,,	54	534	2.00	3.80
2455	2·35	2·0	,,	58.5	577	2.42	2.45
2456	2·35	2·0	,,	56	560	1.90	2.10
,,	2·35	2·0	,,	55	—	—	2.15
,,	2·20	2·0	,,	52.5	575	1.90	5.30
2460A	2·35	2·0	,,	54.5	549	2.20	2.40
,,	1·57	3·0	,,	55	564	2.75	3.30
2460B	2·35	2·0	,,	54	527	2.80	2.65
,,	1·57	3·0	,,	55	588	2.05	2.00
2464A	2·35	2·0	,,	54	568	2.05	2.15
2464B	2·35	2·0	,,	54	524	1.90	2.20
,,	1·57	3·0	,,	53.5	549	2.50	2.60
2465R	2·35	2·0	,,	51	516	0.15	1.60
2504	2·35	2·0	,,	50	515	0.15	—
,,	1·52	4·0	,,	50.5	510	1.80	4.70

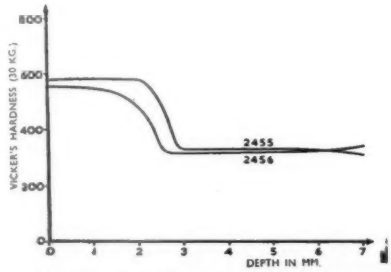


FIG. 6.—*Vickers hardness of self-hardening irons hardened by medium-frequency current (cooled in air).*

2460B, containing 5.39 per cent. nickel, gives the greatest depth of hardening, this no doubt being due to the lowering of the transformation point effected by the nickel.

These tests show that pearlitic irons can be easily hardened to high values by the use of medium-frequency current Ferritic/pearlitic irons can also be hardened provided they contain enough pearlite. Annealed ferritic iron was not hardened under the experimental conditions used. Although currents of higher frequency were not tried, it is improbable that this means of heating would be suitable for surface-hardening ferritic irons. The tests demonstrate the possibility of using current of medium frequency to harden S.-g. alloy irons, cooled simply in air or by conduction.

Flame Heating.

These tests were made at the laboratory at Boulogne-sur-Seine of the Société l'Air Liquide, special thanks being due to Mr. Vilez who directed them. Four types of iron were employed:—(1) a pearlitic iron (26353) with 0.79 per cent. Mn. and 3.87 per cent. C; (2) a ferritic/pearlitic iron (30 per cent. ferrite) (2674F) with 0.26 per cent. Mn; (3) a ferritic iron of the same composition as 2674F, but in the annealed state (2674G); and (4) a self-hardening Ni-Mn-Mo cast iron (2679Q). Quenching was carried out (*a*) by the progressive method, and (*b*) by the method of instantaneous general quench. Measurements were made of the Rockwell C (150 kg.) hardness at the surface and the Vickers hardness (30 kg.) at the surface and in the whole of the hardened zone.

Progressive Quenching.

The tests were carried out on specimens which were rectangular bars 40 × 40 × 200 mm., machined on one of the large 40 × 200 mm. surfaces. By this method, the torch, equipped with its sprayer, travels over the surface to be quenched and hardened (Fig. 7); the rate of travel of the burner varied between 6 and 12½ cm. per minute, the distance of the burner from the surface being between 9 and 14 mm. The pressures and supply of oxygen, as well as the water supply, were kept at values ordinarily employed in quenching and hardening steels and grey iron.

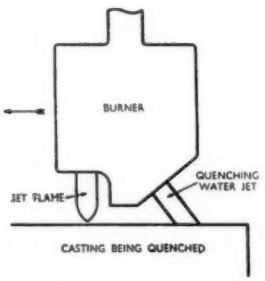
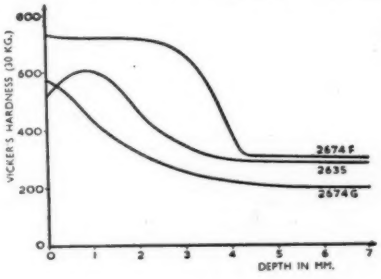


FIG. 7.—*Diagram showing the principle of progressive quenching.*

The pearlitic iron 26353 (Fig. 8) gives a surface hardness of 54 to 55 Rockwell C with a depth of hardening of 1.65 mm., *i.e.* a hardness above 500 Vickers. The hardness is a little low, which must be due to the carbon content being a little too high (3.87 per cent.). The ferritic/pearlitic iron 2674F (Fig. 8), under the same conditions of treatment, gives a higher hardness, 58 Rockwell C, the depth of hardening being between 3.20 and 3.30 mm. By modifying the gas supply and suppressing the protective spray, hardnesses of 59.5 Rockwell C with a depth of hardening of 3.70 mm. could be obtained. Micrographic examination reveals that the surface consists solely of martensite. There is very soon found, however, in the layer underneath, not only martensite but also ferrite which surrounds the graphite, proving that the time and temperature of the heating are not sufficient to produce a homogeneous austenite.

Under the conditions employed for the two irons mentioned the ferritic iron 2674G (Fig. 8) did not give a Rockwell C (150 kg.) hardness higher than 33. The microscope revealed a thin surface layer consisting mainly of martensite. Below this layer, ferrite predominates, although there is martensite around the graphite spheroids, which shows that there has only been limited diffusion of carbon. Quenching a second and a third time, enabled the raising of the hardness to 55 Rockwell C, but the depth of hardening did not exceed 0.6 mm. It would thus appear that completely ferritic irons cannot in practice be hardened by flame-heating under the

FIG. 8.—*Graphs of the hardnesses of bars of three irons flame-hardened by progressive quenching.*



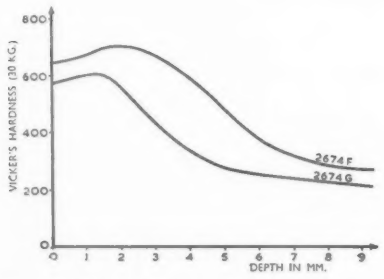


FIG. 9.—*Graphs of the hardnesses of bars of two irons (flame-hardening instantaneous general quench: flame-heating).*

experimental conditions used, although these conditions are perfectly suitable for steels and pearlitic cast irons with a flake-graphite structure.

With the self-hardening iron 2679Q, rapid cooling by water spray can be omitted. Under the experimental conditions, the Authors obtained by means of air-cooling Rockwell C hardness values of 52 to 54½, depth of hardening varying between 1 and 2½ mm.

Instantaneous general quenching.

The tests were made on cylindrical test-pieces machined to 55 mm. diameter, rotating at 60 revs. per minute. The type of burner was that used for surface-hardening steel crankshafts. The main results are summarized in Table XII. The relatively low hardness obtained on the self-hardening iron is due to the presence of austenite associated with high contents of alloying elements. It can be seen that the results closely approximate to those produced by progressive quenching, except that it appears less difficult to quench and harden completely ferritic irons. For the moment, however, hardening of these completely ferritic irons is a somewhat critical operation.

TABLE XII.

	Total period of heating, seconds.	Type of cooling.	Rockwell C hardness 150 kg. at surface.	Depth of hardening $H_V > 500$
Pearlitic 2635S (T.C. = 3.87) ..	41	Water	57.5	7.00
Ferritic/pearlitic 2674F (Fig. 9 and 10)	41	Water	60.0	4.80
Ferritic 2674G ..	41	Water	48	—
Ferritic 2674G (Fig. 9)	60	Water	50.0	2.45
Self-hardening 2679Q	40	Air	43	—

Annealing for the Relief of Internal Stresses

Like steel castings, S.-g. iron castings, having both a high yield point and a high modulus of elasticity, may contain high residual stresses. As in the case of grey iron castings with a flake-graphite structure, annealing for lessening or elimination of stresses is carried out at a temperature below the Ac_1 point, for a period varying with the temperature employed. The rate of cooling is usually very slow. It is generally accepted that a temperature of 600 deg. C. is required completely to eliminate the stresses in flake graphite irons, but this temperature is liable to soften the iron. As a compromise, very slow heating to 450 deg. C. is sometimes accepted, but such treatment certainly does not result in complete relief. The castings have to be introduced into a cold furnace and precautions must be taken when they are being heated up. Cooling has to be slow, at least down to 250 deg. C.

The Authors are not aware of any detailed study of stress-relieving treatments for S.-g. irons. It seems, however, that 550 deg. C. is a minimum temperature and that it might be better to go up to 600 deg. C. in cases where a small amount of softening does not matter. K. D. Millis[6] recommends heating in the range 540 to 680 deg. C. followed by slow cooling in the furnace down to 370 deg. C., at least, particularly when the castings are of complex shapes.

The problem of stress-relief occurs, of course, more particularly with pearlitic irons or ferritic/pearlitic irons in the as-cast state. When the castings have to be annealed in order to obtain a ferritic/pearlitic or completely ferritic matrix, *i.e.* involving treatment at temperatures above 625 deg. C., it is sufficient to cool them slowly if it be desired to avoid new stresses being produced during cooling.

REFERENCES

[10] T. Takase, "Surfacing Hardening of Nodular Cast Iron with High-frequency Currents," *Metal Progress*, 1951, vol. 60, p. 108 (October).
[11] "Stress-relief Treatment of Iron Castings," Report of I.B.F. Sub-committee T.S.17.

FIG. 10.—*Photographs of specimens surface-hardened and turned on a cross section with a tungsten-carbide cutter. Small bar, iron* 2450, *water-quenched after heating by medium-frequency current* (59 *Rockwell C). Large bar, iron* 2674*F, water-quenched, after torch heating, by general immersion. The depth of hardening is shown up by the darker appearance of the surface layer.*

Parliamentary

Development of Inventions

An unopposed Second Reading was given to the Development of Inventions Bill in the House of Commons on January 26. Under the terms of the Bill, industries will be able to put forward practical requirements for inventions.

MR. PETER THORNEYCROFT, President of the Board of Trade, explained that the chief aim was to help expand exports and even create new markets. Leaders of industry would state their case, and if the purpose of the hypothetical invention were approved, all the "inventive genius" which the National Research Development Corporation was there to promote would be set to work.

He did not want to exaggerate the effect the Bill would have, and he pointed out that the Corporation was still at an early stage in its career. It would now be given a further five years in which to make advances—the total amount being unchanged at £5,000,000. In the past five years the Government had provided £750,000 of that sum. The Corporation's expenditure had been limited because it had been very careful over the development or research promoted.

Mr. Thorneycroft said that the revenue, derived from royalties, last year was £25,000; he understood that the revenue next year was likely to be at least double that. He added: "As this Corporation progresses both the amount of money committed on development work and the revenue received from past work are steadily on the increase."

For the Opposition, MR. JOHN EDWARDS welcomed the Bill as a good one, though "very modest."

E.C.S.C-U.K. Agreement Proposal

In a written answer to MR. DE FREITAS, MR. EDEN, Foreign Secretary, said that the High Authority of the European Coal and Steel Community had informed H.M. Government that it wished to enter into discussions in order to establish a formal association between the United Kingdom and the community by means of an agreement. It had also offered certain preliminary suggestions as to what this agreement might contain.

The policy of the Government, said Mr. Eden, was to maintain an intimate and enduring association with the Community, and it had received this proposal with great interest. The High Authority's proposal would require careful study and consultations with the interests concerned.

Replying to further questions, MR. A. D. DODDS-PARKER, Parliamentary Under-Secretary to the Foreign Office, indicated that Government consideration of the High Authority's proposals had been extended to consultation with all sections of the industries concerned. The advisability of publishing a White Paper in due course would be borne in mind, and he promised opportunities of debating it before decisions were made.

Industrial Organization and Development

The purpose of the Industrial Organization and Development Bill, which was published recently, is to widen the scope of voluntary development councils by adding "certain purposes tending to promote productive efficiency" to the list of objects for which a charge may be levied on an industry. These purposes are already within the scope of a Statutory Development Council.

(*Continued at foot of Col.* 2)

The Bill amends Section IX of the Industrial Organization and Development Act of 1947, and it also provides that an Order may be made under this section for an industry which has a development council if an Order dissolving that development council has been made.

THE President of the Board of Trade stated that he had accepted the invitation of the Canadian Government to open the International Trade Fair at Toronto on May 31; he proposed to take the opportunity of making a fairly extensive tour of Canada's industrial centres and the West Coast.

Corrosion Protection

Latest Developments in Industry

It has been estimated that the annual expenditure on protection of metals against corrosion in Great Great Britain is of the order of £200,000,000. Thus, it was of considerable interest to see the latest methods available for protecting iron and steel, at an exhibition organized by the Corrosion Group of the Society of Chemical Industry at Battersea Polytechnic, London, on January 21 and 22. Some 30 exhibits demonstrated the most important corrosion-prevention techniques in five main sections—effect of design, treatment of the corrosive medium, cathodic protection, protective coatings and test methods.

Outstanding Exhibits

The British Iron & Steel Research Association's South Wales laboratories showed examples of coatings for protecting sheet steel, while a new technique for protection of austenitic stainless steels by anodic polarization was shown by the Brown-Firth research laboratories. This method is still in the experimental stage and has a number of limitations still being investigated. It is based on the effect of potential on corrosion rate in stainless steels. A potentiostat was shown being used to protect plant in 18/8 Cr/Ni steels, including pipes, pipe-joints and pumps. A pilot plant was operating with a boiling 50 per cent. sulphuric acid solution. Such a solution would normally cause exceedingly rapid corrosion and would probably destroy the plant in less than one hour. Under certain acid conditions, stainless steels would tend to lose their passivity, take a low potential and corrode rapidly. Any such tendency could be immediately noticed if, as in the exhibit, the potential was measured and recorded. In some cases, it is possible to maintain the potential of the steels within the safe range and thus retain their passivity, even in solutions which normally would cause corrosion, by suitable anodic polarization. The normal rate of corrosion in cool 50 per cent. sulphuric acid was seen on two cylinders placed in the efflux of the plant but the rate at the boiling point was too high to be easily demonstrated.

Diffusion Alloys, Limited, exhibited examples of metals which had been chromized by diffusion technique, while other methods of metallizing were featured by Metallisation, Limited, the Metallizing Equipment Company, Limited, and Schori Metallising Process, Limited. Other companies, including the Pyrene Company, Limited, and Jenolite, Limited, indicated the benefits of phosphate coatings. A comparatively new method of shot- or grit-blasting metal plate, sheet, etc., *in situ* was described by Vacu-Blast, Limited.

Notes from the Branches

London Branch—East Anglian Section

The December meeting of the East Anglian section of the London branch of the Institute of British Foundrymen, which was held at Ipswich, took the form of an "Any Questions" programme, the questions being answered from among the general assembly. Some of these are given below:—

Question (1).—*For grey-iron castings of complicated design and varying thickness which have to be hydraulically sound, is it better to use a relatively low-Si/C iron cast at high temperature, or a relatively high-Si/C iron cast at lower temperature?*

There was no unanimous opinion, but one of the main points raised was the importance of method of gating the castings. One member considered that the mechanical properties of the two irons would vary considerably, the lower-silicon variety giving the stronger iron. This iron would also have a narrower cooling range.

Question (2).—*When preparing to lay-out a running system for small, mass-produced castings, what principles of running and risering are adapted with grey iron?*

The following principles were generally agreed upon: (1) Run in to the thin sections so as to equalize cooling; (2) runners should be kept away from surfaces to be machined; (3) two ingates were better than one, and three better than two, and (4) the use of shrink bobs and Connor runners were better than risers.

Question (3).—*Why is it that castings do not contract in depth as they do in length and width?*

This peculiarity had been noticed by at least three firms working in steel, grey iron and Meehanite, and was most noticeable on castings varying from 10 in. to 7 ft. in depth. There appeared to be no straightforward explanation.

Question (4).—*Can one obtain a cleaner casting by using a chill instead of a core at the section where the bulk of the metal lies? Does the metal take the same course when poured against a vertical core as compared with a vertical chill, that is, clockwise or anti-clockwise flow?*

One opinion given was that top running, with pencil runners, would ensure outer surfaces being clean, whilst runners directed towards the centre would ensure the cleanliness of the inner surface. As to the direction of flow, the chill would probably break or slow down the metal, causing an alteration of direction.

Metal Spraying

The first meeting of 1954 took place on January 19, when MR. J. BARRINGTON STILES, of the Metallizing Equipment Company, Limited, presented his Paper, "Metallizing in Relation to Foundry Practice". Mr. Stiles was introduced by MR. H. WARD, president of the section, and then read his Paper (which was illustrated by various slides) and outlined the different aspects of metal spraying as an aid to foundry techniques.

The discussion was opened by MR. CHILD, who asked whether the application of metallizing to cast iron was successful.

MR. STILES replied that metallizing was used for cast iron very regularly, particularly where blowholes were concerned, and the metal sprayed was usually a high-carbon steel, although in some processes, zinc was used as standard practice. Cast-iron chilled rolls could easily be metallized with stainless-steel wire.

MR. BERRY referred to a slide of a crankshaft which was sprayed with chromium wire, and asked if any difficulty was experienced with the chrome mating with the base metal. Also, what undercoating was used with this method?

MR. STILES, in reply, said that crankshafts were sprayed with a high-chromium alloy, the undercoating being a molybdenum alloy. Generally, this method was not very costly, only a small amount of wire being used.

MR. WHIPP asked if any trouble was experienced with spraying wooden patterns with metal, as, in his experience, there was a tendency for the metal to scale from the wood after a short time. He was also concerned to learn whether cracks appeared after metallizing a repaired casting.

MR. STILES said that when metal tended to scale from wooden patterns, it was probably due to resinous material in the wood; it was an essential pre-requisite for the wood to be perfectly dry. He said that cracks had been known to occur in shafting, the reason for this being the high shrinkage characteristics of the greater thickness of metal sprayed on, particularly when low-carbon steel was applied. Excess oxygen also produced cracking, but this could easily be remedied if a flow meter was used to control the flow of oxygen.

MR. WASH asked if any after-treatment was necessary when alloy wire was used, as this had air-hardening properties.

MR. STILES replied that heat-treatment after spraying was not really necessary, as an appropriate wire to suit individual purpose was readily available.

Mr. Carrick, proposing a vote of thanks to Mr. Stiles, said the speaker had given a very clear exposition of the various methods of metallizing, and he thought that the process could be usefully employed in the foundry particularly for patterns.

Bristol and West of England

The December meeting of the Bristol & West of England branch was held in Bristol, when a Paper entitled "Metallurgical Progress in British Ironfounding" was presented by Mr. W. W. Braidwood. The lecturer outlined a number of advances made in recent years and dealt particularly with improvements in cupola design and operation, with high-duty grey irons, special alloy cast irons and spheroidal-graphite iron. From the discussion which ensued it was clear that the members had found much to interest them, especially on the subject of S.-g. iron. In the course of his replies to questions, Mr. Braidwood made the point that the practical limitations of section thickness and mass which apply to castings made in conventional malleable cast irons did not apply to those in S.-g. iron (of which castings have now been made weighing up to about 50 tons).

The lecturer emphasized that S.-g. iron should not be regarded solely or mainly as an alternative to malleable iron. Irons containing spheroidal graphite were a new "family" of high-grade materials with properties which could be varied over a wide range to suit requirements and which were establishing themselves in many applications—some quite new to the ironfounding industry. Methods of founding applicable to S.-g. irons were discussed and, in answer to questions on procedures for the introduction of magnesium, the lecturer stated that copper was of limited interest as a carrier for magnesium, not only because of its low efficiency but also because of the adverse effect that the presence of copper could exert on the graphite form and its potent influence on the stability of pearlite. At the close of the meeting, Mr. J. Hayward proposed, and Mr. I. J. Birch seconded, the vote of thanks to the lecturer.

Selecting Ceramic Coatings*

By W. C. Rous, Jnr.

This American report states that five general types of ceramic refractory coatings are available and that work continues to expand and modify compositions to meet new service demands. It is clear that the potentialities of this new field for refractory ceramics are rapidly expanding.

A ceramic coating for application to a metal component for conferring high heat resistance must meet the following requirements:—

1. It must adhere well to the base metal.
2. It must be thin. Thin coatings improve adherence and minimize cracking, chipping, and thermal-shock damage. They also reduce weight, improve ability to withstand centrifugal forces, and improve resistance to tearing of the "bisque" (the dry but unburned coating) on firing.
3. It must have physical stability. Resistance to mechanical impact and high-frequency vibration are particularly important.
4. It must have chemical stability. Primarily, it must be inert to normally corrosive gases and have a low rate of solvent action on the base metal.
5. It must have high thermal-shock resistance.
6. It must be impervious to gases.
7. It must have a thermal expansion coefficient fairly close to that of the base metal. When the coating thickness exceeds 0.002 to 0.003 in., matching of base metal and coating thermal-expansion coefficients becomes critical and the coefficients should match almost perfectly.
8. It must be free of "re-boil"—gas bubbles usually occurring at or near 540 deg. C. when coated mild-steel is reheated after the original firing operation.

Performance Required

Coatings should also perform these functions:—

1. Protect the base metal from corrosion by or absorption of gases. Ceramic coatings give protection against reducing or oxidizing atmospheres, sulphur dioxide or trioxide, carbon, sulphur and, to some extent, chlorine.
2. Protect the base metal from erosion by high-velocity gases.
3. Reduce warping, buckling or cracking failures in sheet metal, by decreasing hot spots.
4. Serve as a heat barrier. This can be done with refractory insulating materials or, in thin vitreous coatings, by including low-emissivity ingredients which can be effective when the hot gases are quite luminous.
5. Increase strength and stiffness by lowering the effective operating temperature.
6. Allow use of thinner gauge metal without forfeiting "life."
7. Increase flexural rigidity by increasing the thickness of the part. Some other process, such as metallizing, might be more satisfactory where this is the primary consideration.
8. Allow special characteristics to be incorporated in surface, such as special textures, smoothness, various electrical properties, mechanical pre-stressing, abrasion resistance and anti-galling characteristics.
9. Increase fatigue strength by elimination of surface stress raisers. Also reduce corrosion fatigue, and dampen vibrations.

Service Features

Ceramic coatings, essentially refractory versions of the conventional glassy porcelain enamels, are generally considered for one of three purposes:

1. To allow the substitution of less-strategic alloys without sacrificing service "life."
2. To lengthen the service "life" of existing parts.
3. To allow use of existing parts at higher operating temperatures.

Each of these objectives has a particular significance at the present stage of jet-engine development. As a result, there is increasing interest in the use of ceramic coatings for jet-engine parts.

Ceramic coatings were applied to automobile silencers before world war II. During the war, ceramic coatings were used on turbo-superchargers. Now they have only limited application on jet-engine parts, but many manufacturers of jets, guided missiles and conventional aircraft, here and abroad, have ceramic-coated jet parts under development and test. Present development work on ceramic coatings has three main objectives:

1. Development of more-refractory compositions and of insulating coatings.
2. Modification of compositions to fit the growing list of metals and environments contemplated by design engineers.
3. Determination of physical and engineering data on coated specimens and parts.

In general, a ceramic-coated part is more effective if it is considered as a special compounded material of definite and distinct properties rather than merely as "painted" metal.

Types of Coatings

Ceramic coatings of possible use in aviation gas-turbine applications can be classified as follows:

1. Ordinary refractory coatings similar to those used on automobile silencers. These are essentially porcelain-enamel formulations, with refractory additions, and are applied in conventional enamel thicknesses (0.003 to 0.008 in.).
2. Extremely thin (0.0005 to 0.0025 in.) coatings of the above composition. An example is (U.S.A.) Bureau of Standards type A-418.

* Substantially reprinted from *Materials & Methods*. The Author is attached to the Aircraft Gas Turbine Division of the General Electric Co. (U.S.A.).

Selecting Ceramic Coatings

3. Highly-refractory metal-bonded oxide, carbide or nitride coatings, generally known as "cermets." An example is Ohio State's magnesium oxide 65 per cent. nickel flame-sprayed coating.

4. Refractory insulating coatings attached to the base metal by cementing or by mechanical techniques.

5. "Ceramic paints" which can be brushed on and require no firing prior to use.

Coatings of Mild Steels

Coatings for mild steels are generally variations of the Bureau of Standards A-19 coating which has a high aluminium-oxide content (composition given in Table I). A-19 has a higher thermal-expansion coefficient than conventional coatings and therefore more closely matches the expansion of the base metal in heating. However, it also has a higher softening temperature which means it may be under greater stress after cooling to room temperature due to the higher temperature at which it became rigid. A-19H which has a still higher aluminium-oxide temperatures approaching 650 deg. C. and has good thermal-shock resistance. Improved resistance at temperatures up to 675 deg. C. can be obtained from A-19H which has a still higher aluminium oxide content. The A-19 coating matures at 860 deg. C. and A-19H matures at 880 deg. C.

Commonly-used mild-steels are 1010 and Ti-namel. For better hot-strength, low-alloy steels such as 4130, N-A-X, 17-22-V and Chrom-alloy are used as the base metal. If more than a single coating is to be applied to mild-steel, it is important that the carbon content does not exceed 0.15 per cent.

Coatings for Stainless Steels

Another Bureau of Standards coating, A-418, is widely used on stainless steel. (See Table I for composition.) Its texture ranges from semi-matte to semi-gloss, depending on how it is applied. The Solaramic 5210-2C coating is glossier. Both will protect stainless Type 321 from corrosion at 925 deg. C. for at least 200 hr. (in laboratory testing) and will withstand 10 cycles of heating to 870 deg. C. and quenching in water. Maximum usable temperature for these coatings is 980 to 1030 deg. C.

TABLE I.—*Two Important Ceramic Coatings.*

Per cent.	A-19.	A-418.
Composition (by weight):		
SiO	36.3	28.6
BaO	—	33.7
B_2O_3	14.1	4.9
Cr_2O_3	—	23.0
CoO	1.3	—
ZnO	—	3.8
NiO	0.5	—
K_2O	3.6	—
Al_2O_3	26.4	0.8
CaO	4.5	2.7
Na_2O	12.3	—
MnO	1.0	1.9
Clay-mill addition, per cent. by weight	10.9	5.0
Firing temp., C. (approx.)	871	1,025
Firing time, min. (approx.)	10	10

Ceramic-coated stainless has been used to replace uncoated "high" alloys where straight corrosion protection of hot parts is needed. In some cases significant savings in critical alloying elements can be made. However, experience on the J-47 engine liners has been mixed, with both uncoated Inconel and coated 321 stainless proving superior in different models and under different conditions. Other base metals successfully coated include types 310, 347 and 430, and 19-9DL.

Coating of Non-ferrous Metals

In certain limited applications where the temperature exceeds 1090 deg. C., L-605 (cobalt/chromium/tungsten/nickel) burns out. Several vitreous coatings have increased the engine operating time of this metal. Ceramic coated Hastelloy B withstands laboratory testing at 980 deg. C. On the other hand, A-418 has been applied to welded Inconel W stress-rupture specimens without appreciable advantage. Other base metals being evaluated include S-816, Vitallium, A-286, N-155, Inconel and Hastelloy X.

Insulating Coatings—A good example of a mechanically attached insulating coating is the system originated by the General Electric (U.S.A.) Research Laboratory. Stainless sheet is punched to form projecting tabs (U.S. Patent No. 2,564,497) and is then covered with a thin, vitreous coating designated 8473-C1. This is followed by a thick mixture of magnesium oxide and 8473-C1 which matures at 995 deg. C. Development of this type of coating is taking place slowly, but progress is being made.

Since the melting point of magnesium oxide is 2800 deg. C., the operating temperature for this type of coating is limited by (1) the refractoriness of the glassy base coat and binder, (2) the time temperature dissolving of iron from the base metal at temperatures above 1370 deg. C. (the melting point of iron oxide), (3) the thermal-expansion characteristics at the interface between coatings, and (4) the thermal-expansion characteristics at the interface between the vitreous base coating and the base metal.

Ceramic Paint

The so-called ceramic paints are normally oxides or carbides in a soluble-silicate vehicle and are intended for field applications where starting up the engine will mature the binder. These coatings can be used for oxidation and corrosion protection or for radiation control. One such coating, developed by the University of Illinois and designated as CP44, was used on airplane exhausts during world war II; it cut down the visible radiation from red-hot exhaust stacks as much as 90 per cent. This type of coating is of a temporary nature, feasible for repair work or for special uses where conditions are not extremely severe. A more permanent coating would be obtained by application of a fired base coat before engine assembly, followed by application of a ceramic paint after engine assembly. The glassy base-coat provides more permanent adherence for the insulating coating.

Coating Tests and Failures

Prior to engine testing, ceramic coatings are usually subjected to laboratory screening tests. They include: thermal-shock test from nominal operating temperature to water for 10 cycles, extended heating at about 100 deg. C. above operating temperature for 48 to 72 hr., adherence tests involving bending or deforming in a die or press, impact tests, stress-rupture and fatigue tests, and long cyclic gas-heating tests.

Tests run on coating materials before application include Button fusion tests and coefficient of expansion correlations by interferometer techniques or by measurement of expansion and contraction forces in a coated sheet-metal ring. Microscopic examination is used to determine base metal and coating deterioration during various phases of laboratory testing. Currently, the Wright Air Development Centre is acting as an initiating and liaison agent in an effort to standardize laboratory screening tests throughout the country for ceramic coatings with air engine applications.

Although coatings may not be needed on both sides of a part for protective reasons, a great deal of needless failure due to distortion can be eliminated by coating both sides. Such distortion is caused by the unbalanced stress set up by the difference in expansion and contraction rates between the coating and the base metal. Some designs may resist distortion, but the unbalanced stress will still exist.

Coating failure caused by excessively large compression stresses (as where temperature gradients and thermal shock are augmented by mechanical buckling stresses) show up as bare areas where the coating has "popped" off. Sometimes fine cracks allow gases to escape freely from the metal; in other cases the constriction of these fissures and the fact that the temperature exceeds the softening point of the glass result in formation of blisters. Where failure in tension occurs, rows of blisters may occur along the line of rupture. In compression failure, the distribution of cracks and blisters tends to be more random.

Coating failure may also occur as a result of oxidation in the base metal under the coating. Usually the oxide is absorbed into the coating as it is formed until a saturation level is reached. Then adherence usually deteriorates and the coating flakes off.

Coating Processes

Ceramic-coating processes can logically be considered in three parts: formulation of the coating, preparation of the metal surface, and application and firing of the coating.

Coating formulation—Ceramic coating formulations are inorganic, earthy materials composed mainly of quartz, feldspar, clay, chromic-oxide, aluminium-oxide, borox, cryolite, fluorspar and calcium-barium-magnesium carbonates. Compounds other than oxides are considered in terms of their theoretical oxide components for the purpose of calculating the batch composition. The sequence of coating formulation is as follows:

(1) Weigh, mix, smelt, quench, dry and store as frit.

(2) Weigh frit with mill additions; ball mill, test, store and age.

(3) Adjust specific gravity pick-up and set-up characteristics of the coating slip.

Metal preparation—Preparation of sheet metal for ceramic coating is subject to several variations depending on the type of base metal, the characteristics of the coating and its purpose. Following are three sequences used on mild steel:

(1) Clean chemically, water rinse, pickle, water rinse, neutralize, dry.

(2) Scale, pickle, water rinse, plate nickel "flash," water rinse, neutralize, dry.

(3) Anneal, shot blast.

A more detailed outline of one satisfactory sequence for stainless steel is given in Table II.

TABLE II.—*One Method of Preparing Stainless Steel for Ceramic Coating*

(1) Clean—
- (*a*) Emulsion clean ½–1 min.
- (*b*) Hot water rinse (180-212 F.).
- (*c*) Immerse in heavy duty alkaline cleaner 5-15 min.
- (*d*) Cold water rinse.
- (*e*) Hot water rinse (180-212 F.).

(2) Anneal—10 min. at 1,800 F. cool.

(3) Pickle—
- (*a*) Dip in 15 per cent. hydrochloric acid at 160-180 deg. F. for 10-15 min.
- (*b*) Hot water rinse (180-212 deg. F.).
- (*c*) Dip in 10 nitric-2 per cent. hydrofluoric acid at 180-200 deg. F. for 15-30 min.
- (*d*) Hot water rinse (180-212 deg. F.).
- (*e*) Cold water rinse (air water gun).
- (*f*) Neutralize in sodium carbonate (4 lb. per 100 gal. water) at 160-180 deg. F. for 5-10 min.
- (*g*) Hot water rinse (180-212 deg. F.).

(4) Mask—all areas not to be coated and not to be blasted.

(5) Blast.

Applicating and firing.—The controlled coating slip is applied to the prepared metal surface by dipping or spraying. The coating is then dried to form a bisque.

Ordinarily, maturing temperatures range from 545 deg. C. for coatings on aluminium to 1090 deg. C. for coatings on Inconel. High-temperature coatings on mild steels are usually fired at about 870 deg. C. Firing is done at the minimum temperature that will permit maturing within a practical time limit. At unnecessarily high firing temperatures, metal deformation and excessive oxidation occur. Sometimes neutral or reducing atmospheres are helpful in firing. On low-carbon steels, the coating must fuse and seal off oxygen early in the heating cycle before excessive oxidation can occur. On alloy steels, however, fusion of the base-coat must be delayed until enough metal oxide is produced to promote good adherence. Firing temperatures for alloy steels commonly range from 950 to 1065 deg. C.

Higher firing temperatures have been used with some materials. A glass-like modified barium aluminium silicate coating has been fired on alloy steel at 1200 deg. C. Firing temperatures ranging from 1200 to 1540 deg. C. have been used with a chromium-frit glass coating in attempts to protect molybdenum.

Publications Received

N.R.C. Titanium Casting Process. Issued by the National Research Corporation, Massachusetts, U.S.A.

This very interesting mimeographed report has been produced with the object of outlining recent progress which the Corporation has made in the production of titanium and forms the basis of offers of non-exclusive licences. It sets out the preparation of pattern and the mould flask. The actual mould is made by mixing a powered refractory with a liquid binder and pouring the resulting slurry over the pattern. The slurry solidifies and so forms one half of the mould. Then there is a low-temperature baking followed by a high-temperature firing. The mould is placed in the furnace, which is shown diagrammatically, and titanium sponge or scrap is placed into a saucer-shaped graphite crucible, lined with a special refractory. The furnace is then sealed and evacuated, argon being subsequently admitted under pressure. Then power is applied to the electrode and melting starts. An observation window enables one to judge when the bath is properly melted. Then the electrode is moved and the melt is poured into the mould placed in the path of the stream. The mould is cooled for half an hour still under argon or vacuum to a temperature below the temperature at which it reacts with the atmosphere. With the installation in use at Cambridge, Mass., the maximum weight handled is 5 lb.

The properties of two grades of metal are given—pure titanium and a 4 per cent chromium, 2 per cent molybdenum alloy. The former gives 60 to 63 Rockwell "A" hardness; Charpy impart value 11 and on analysis yields: impurities 0.1 to 0.2; N. 0.03 and C. 0.08 to 0.15 per cent. The alloyed metal is reported as having 65.5 Rockwell "A" hardness, a Charpy figure of 8.4, and a tensile strength of 57 tons per sq. in. Its impurities are stated to be N. 0.03 to 0.05 and carbon 0.1 to 0.15 and undetermined 0.3 per cent.

The report, which is available to readers on writing to Cambridge, Mass., concludes with a photograph of some castings made; a radiograph of a cover-plate, and schematic diagram of a titanium casting furnace.

Edward Curran Companies—a Review of Half a Century. Published by Edward Curran Engineering, Limited, Cardiff.

The early activities of this Group of companies was the designing of new types of furnaces, culminating in the autumn of 1914 with the construction at Ward End, Birmingham, of not only furnaces but the actual buildings and other equipment for the production of 4.5 in. cartridge cases and fuses. Next, the firm decided to take their own medicine and constructed a factory of their own for this purpose. Before this, however, in 1910 the Curran family had established the Cardiff Foundry & Engineering Company to supply the furnace building company with castings, but during the war it made large quantities of ingot moulds. In 1920, an organization—Edward Curran & Company, Limited—was formed to manufacture vitreous-enamelled ware. The next venture was a new company, Curran Oils, Limited, which created a 4,000-ton oil depot at Queen Alexandria Dock—since grown into 2,500,000 tons storage capacity. The Cardiff Foundry Company was early in the field of mechanization, using a plant designed by the late Mr. F. J. Cook and built by Herbert Morris, Limited. It was engaged in the production of municipal castings. Other foundry specialties, including illuminated traffic bollards, were developed. The second world war saw the Group returning to the production of munitions of many varieties and interesting types. After the war there was a reorganization—the Cardiff Foundry & Engineering Company was bought by the Birmingham Small Arms Company, Limited, but the power-press and traffic-bollard sections were transferred to Curran Steels, Limited. Soon, there were activities in connection with the maintenance of open-face coal-getting machines and agricultural implements. An enamelling company has been established in Ireland (formed in 1946). Thus from 1903 to the present time, the Curran activities have grown from a one-man business to a concern employing about 2,000 people.

Accidents—How they Happen and How to Prevent Them. Published quarterly for the Factory Department, Ministry of Labour and National Insurance, by H.M. Stationery Office, London. (Price 4s. 6d. per annum, post free.)

In this issue there is an illustrated account of a liquid metal burn due to a man slipping whilst pulling a two-wheeled bogie ladle, carrying no third wheel, as is obviously desirable in the interests of safety. A sketch is included to show how an extra wheel attachment was carried out.

1953 Illustrated. Issued by Dorman, Long & Company, Limited, Middlesbrough.

Each year this company issues to its staff an illustrated account of the work achieved during the previous twelve months. It is well produced and illustrated in colour. Much of the information is given in potted form for easy assimilation. The second stage of the great Lackenby project is now finished.

House Organs

Carron Cupola, Vol. 5, No. 1. Issued by the Carron Company, Falkirk.

There is much to be learnt—and applied—from Mr. Payne's introductory article in which he catalogues a short list of contracts that should have been but were not placed in the country. An illustrated article details the activities of the Burnbank Foundry Trades Centre, and gives the impression that it is a well-equipped and progressive school.

Newsletter, Vol. 6, No. 1. Issued by the David Brown Group of Companies.

This issue carries an excellent picture of a half-turbine case mould, made in a cement/sand mixture and a second one of the largest casting ever made in the Salford works (David Brown-Jackson). It weighed 37 tons as cast and is a gear-wheel destined for a South Wales rolling mill.

Albion Works Bulletin, Vol. 7, No. 3. Issued by John Harper & Co. Ltd., Willenhall.

This issue devotes considerable space to a farewell party given to Mr. H. Field who has retired from the Board of directors of the main company after 40 years continuous service with the firm. In this enterprising and very old-established concern it is interesting to read "Methods engineering and work simplification are coming more and more into evidence."

The Stantonian, December 1953. Published by the Stanton Ironworks Company, Limited, near Nottingham.

This issue tells in some detail of the educational activities of the Company. It reports that 364 students gained awards totalling £1,569. Mr. Gerald Brown received the diploma of the National Foundry College at the new college at Ilkeston, 58 apprentices were reported to be taking practical courses on foundrywork and patternmaking. The record of successes in the City and Guilds' examinations is distinctly creditable. Mr. J. Masson, an apprentice moulder, gained a first-class certificate in the final Foundry Practice Examination and also the "Scopes" cup.

East Anglian Founders Install Enamelling Plant

Modern Layout and Equipment at Suffolk Iron Foundry (1920) *Limited*

Recently-completed extensions at Suffolk Iron Foundry (1920), Limited, ironfounders and domestic-goods manufacturers, of Stowmarket, include a modern shop for vitreous-enamelling. For many years, enamelled table-tops for the firm's wringers and mangles have been purchased and it is the internal home production of these which is mainly catered for by the new plant. However, vitreous-enamelled finishes have now been adopted for modern designs of domestic mincers, made at the Suffolk foundry in large numbers, and these form the second main production item to be undertaken in the new department, although, of course, some of the models are still tinned. As the layout and methods of the foundry have been described elsewhere,* the present article will be confined to the new finishing plant. This is by no means unorthodox, but the layout includes refinements of detail and plant not always embodied in a single installation.

Fig. 1 is a plan view of the building, from which the sectional arrangements can well be appreciated; these include pickling, shot-blasting, mill-room, spraying and dipping, drying, firing, inspection and despatch. The whole is housed in an L-shaped sheel-framed building, with walls formed of precast blocks and a roof of corrugated asbestos. Extraneous dust being one of the major enemies of enamellers, its exclusion has been carefully considered in the ventilation system. There are separate washroom facilities for the enamelling staff who, on full production, are expected to number 50 to 60 persons; lockers for their clothing are also installed and white overalls are supplied. The shops are heated as a result of the process carried on, and are well lit by tungsten-filament lamps generally, and locally also at spray booths, etc. All floors are of concrete.

Cleaning Sections

On arrival at the plant, according to whether sheet-steel or cost articles are to be handled, the components are segregated to a pickling shop or first to a shot-blast plant (see Figs. 1 and 2). The latter is a Spencer-Halstead barrel-type unit for mincer castings, but flat-type castings to be enamelled are treated elsewhere on a Gutmann rotary-table plant (for which the firm are the British selling agents).

The pickling plant (Fig. 2) comprises, with 7 by 4 by 4 ft., 1,000 gallon capacity tanks in line:— (1) I.C.I. trichlorethylene degreaser, type V3; (2) aqueous degreaser; (3) cold rinse, taking the overflow from the trichlor[1] cooler; (4) cold, 15 per cent. hydrochloric acid; (5) acid rinse, cold; (6) neutralizer —soda-ash and borax—and (7) a drying tank, employing recirculated steam-heated hot air (nearest the camera in Fig. 2). The overhead monorail hoists were made by Yale & Towne Manufacturing Company, Limited. As no jobbing work is ordinarily undertaken, the ware is processed in batches—sheet-iron table tops or cast mincer parts as desired.

Mill-Room

Fig. 3 is a view of the mill-room, which is housed adjacent to but well isolated from the shot-blast room and pickle plant. The three sections comprise the leg of the L-shaped building, and are in turn isolated by quite narrow communicating ways so as to minimize dust or fume contamination between sections. One 500-lb., two 250-lb., one 100-lb., and one double-jar unit comprise the mill-room plant. All mills were supplied by Incandescent Heat Company, Limited,† and comprise the usual elevated rotary-barrel-type structure lined with porcelain blocks and directly driven by individual motors. The grinding media employed are graded flint pebbles and loading and charging is practised from the platform at the rear, discharge being effected into bins arranged below. Pro-

* JOURNAL, May 3, 1951, p. 463.
† This Group was responsible for the majority of the S.I.F. enamelling installations.

FIG. 1.—*Layout of the vitreous-enamelling department at Suffolk Iron Foundry* (1920) *Limited showing the process segregation.*

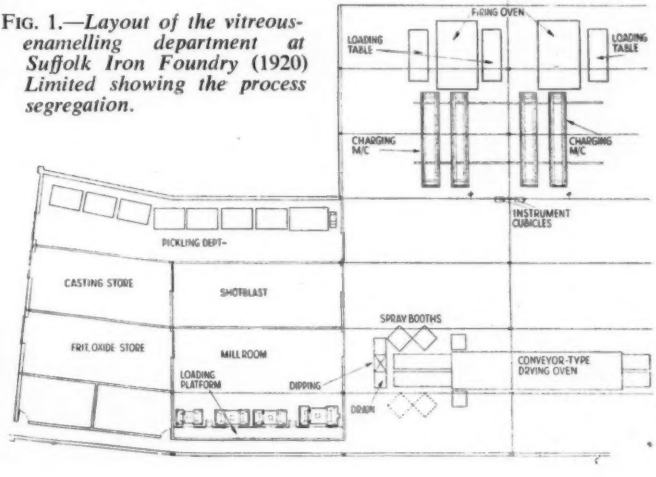
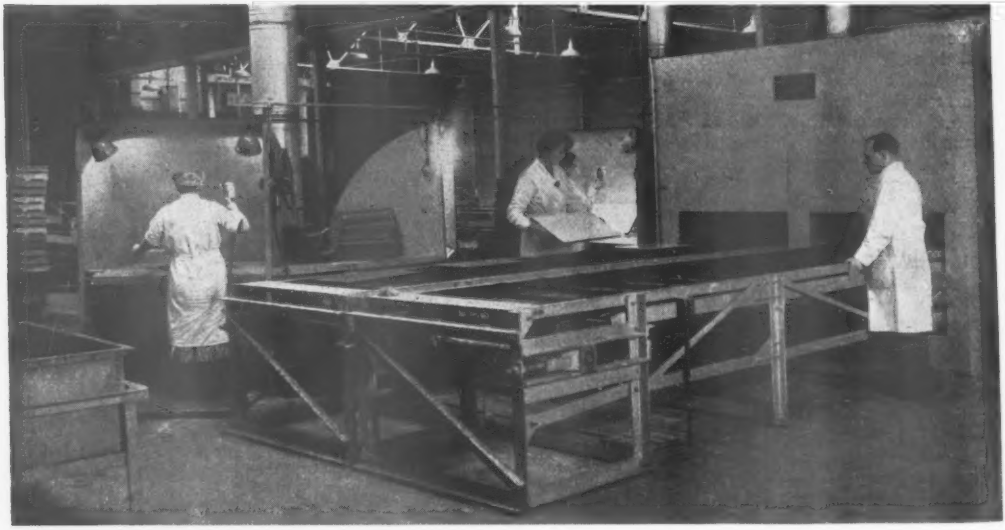


FIG. 2.—*Pickling shop, comprising a line of vats, steam heated as desired, spanned by monorail and electric hoists.*

FIG. 3.—*Part of the mill-room. The operator is charging one unit from the platform. On the r.h.s. is the electrical control panel.*

prietary brands of frit are purchased. The quality of "slip" is maintained by a wet-process check on 150 and 200 mesh screens and a dip-weight value on the grip-coat of 6 oz. per 2 sq. ft. test-plate. The raw enamel is screened in an "Olympia" sifter to 40 mesh screen and a batch-type magnetic separator by Rapid Magnetting Machine Company, Limited, is employed. For washing out the mills, there is an overhead water-line with hose connections, and a separate wash tray in the mill-room is used for equipment washing. A settling pit has been built outside the shop for mill-room waste. All starting and isolating electrical equipment for the mill-room is embodied in one control panel and time-switch

FIG. 4.—*Loading point on the double-conveyor drying oven, showing the arrangement of spraying booths.*



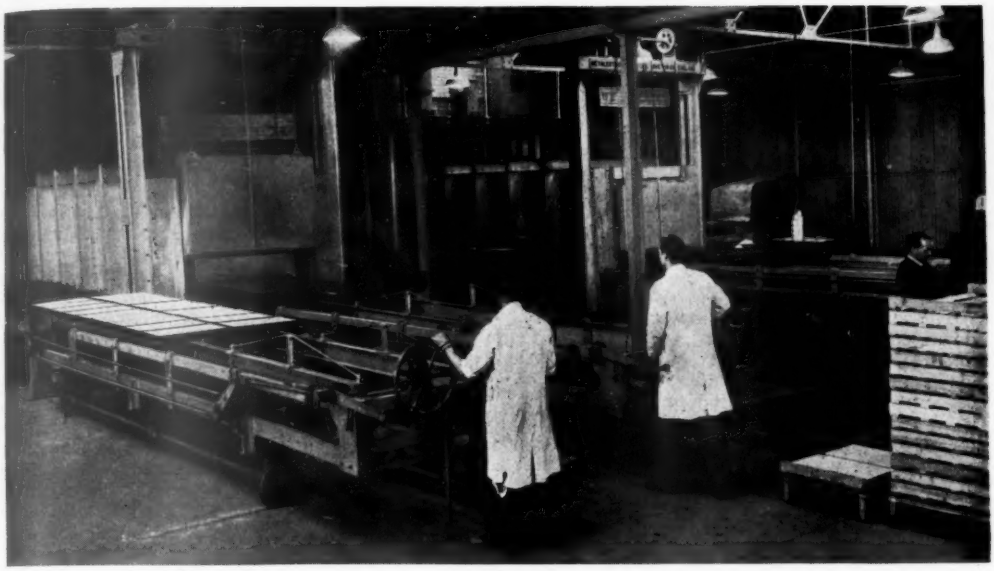


FIG. 5.—*Operating one of the pair of electric furnaces for firing the enamelled ware. Note the cooling table at the side.*

operation is incorporated for each unit—including the jar mills. A frit stores (capacity 30 tons) is situated adjacent to the mill-room and oxides and small quantities of mill-addition materials are separately accommodated. Bins are moved on an undercarriage-type of bogie, for which there is space allowed under the mills.

Enamel Application

The next operation in the flow-line production is enamel application and drying. The latter is carried out in a continuous-type steam-heated plant located in the main shop. For the grip-coating (of sheet-iron ware) a dipping-tank asembly operated by two men is situated in front of the dryer. Spray booths for sheet-iron-enamel application are grouped around the loading end of the dryer, as shown in Figs. 1 and 4; at present four booths are in use, on one side, but as production increases two additional booths are to be installed on the opposite side. The booths were built by S.I.F. themselves and incorporate down-draft dry-extraction unit, leading by ducting to a wet precipitator from which the sludge is discarded. This precipitator was designed by the firm and is considered to be exceptionally efficient. At the booths, it is the practice to reclaim spilled black and

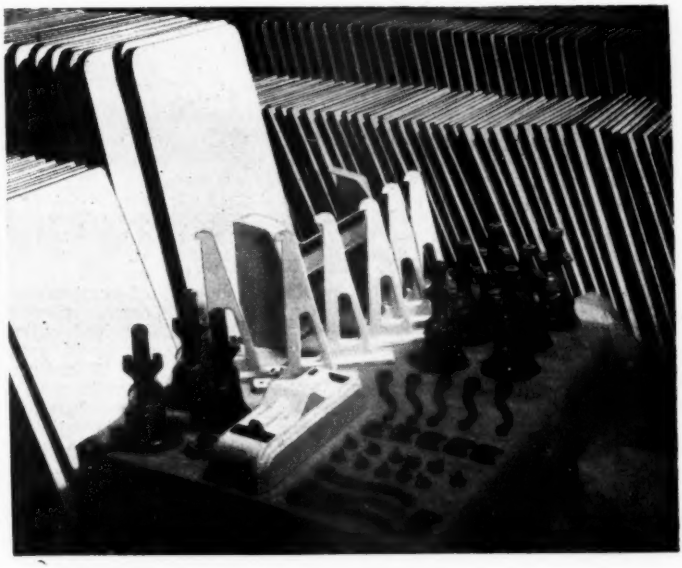


FIG. 6.—*Group of components vitreous enamelled by S.I.F. Included, in addition to table-tops, are bodies and other cast parts for mincers, a scale body and cast-iron brackets.*

East Anglian Founders Install Enamelling Plant

coloured enamels but not whites. Hand-operated aluminium turntables are installed in the booths. For the white-enamelled table-tops, after a dipped grip-coat of 0.005 to 0.006 in., the ware is sprayed with black-edge enamel, followed by a 0.004-in. sprayed one-coat white. The latter is applied at 45 lb. per sq. in. pressure, using " Aerograph " gun equipment. The spraying booths are illuminated each by two 100 w. tungsten-filament lamps fixed at the front corners.

Drying

The continuous dryer consists of two parallel lay-down conveyors, 60 ft. long, running at speeds infinitely variable up to 30 ft. per min. These are loaded at one end (Fig. 4), where 12 ft. of the conveyor projects from the oven proper, which latter is 40 ft. long; 5 ft. is allowed at the discharge end for off-loading. For entry of the ware there is an opening 3 ft. wide over each conveyor adjustable to 3 ft. high. The installation is thermostatically controlled and of the recirculating type, built by Controlled Heat and Air, Limited, and S.I.F. It takes mains steam at 30 lb. per sq. in. pressure; the heating chamber is well lagged throughout. Table-tops are passed through at 10 ft. per min. for cover-coat and black-edge and grip-coat cast iron is dried at the slow speed of 4 ft. per min. Transport of ware about the enamel shop is arranged on wooden stillages and frames, shifted by lift truck.

Firing

Firing of the ware is conducted in a battery of two " Metalectric " 250 kw. electrically-heated units, shown in Fig. 5, disposed in the shop as shown in Fig. 1. Each furnace is divided into two heating zones, front and rear, the total internal space being 5 ft. by 12 ft. by 1 ft. 10½ in. to the spring of the arch. Elements are incorporated in the roof arch and in the floor—there they are protected by heat-resisting hearth plates. Experience has shown the heat insulation to be extremely efficient. The rear zone is the largest and it is found possible for " firing " to be conducted within 1 ft. of the door. Control is fully automatic, through a control panel located at the endl of the charging forks; and a control unit for each mounted on a platform above the furnaces. Each furnace is equipped with two " Electroflo " indicating pyrometers and a recorder is to be fitted. Door opening is effected by electric hoisting mechanisms worked from switches suspended from flexible cables above the operators.

Capacity

Special fusing jigs have been designed for firing mincer parts, which are processed in green-mottle enamel at the rate of 68 sets per charge—a set comprising body, handle, clamp-plate and wing nuts. Table-tops are " fired " at the rate of 18 of the 14 by 23 in. size per charge. Very shortly, firing is to be put on a continuous, 24-hr. day basis, so as to utilize the full efficiency of the furnaces. Scrapped ware, at the time of writing, runs at less than one per cent. for table-tops, with about 10 per cent. re-worked. For cast iron, between six and eight per cent. is re-worked, but there is virtually no scrap.

For the present enamelling programme, the firm intends to step up production of table tops of various sizes and an automatic spraying unit is to be incorporated shortly. Cast-iron vitreous-enamelled mincer production is kept at a high level for the home and export trade. Also envisaged is the extension of vitreous enamelling to wringers and scales and, eventually, the whole range of the firm's production, including enamelling to the trade. A view of some finished ware is shown in Fig. 6.

Midlands Exports

Midlands exports during 1953 were almost unchanged in volume from previous years except that, during the last quarter of the year they were probably higher in volume than in any previous quarter since the war, Mr. Barry Kay, Regional Controller for the Board of Trade and Ministry of Supply, told the Midland Regional Board for Industry in Birmingham on January 26. He said that exports to North America, especially Canada, were higher than ever before.

With reference to the coming year, Mr. Kay said that there was very lively interest in the Midlands in the whole field of exports to match activities of oversea competition. Prospects depended on Britain's ability to compete successfully with oversea rivals, not only by keeping down costs and prices, but also by showing vigour and drive in selling methods. He advised Midland manufacturers with products to sell in Canada to consider seriously exhibiting at the Toronto International Trade Fair in May and June. The opportunity offered by this fair was one that should not be missed.

Tees-side Apprentices' Competition

At the January meeting of the Tees-side branch of the Institute of British Foundrymen, which was referred to briefly last week, Mr. Charles Wilson, senior vice-president, gave to members details of the number of entries which had been received for a competition arranged for Tees-side apprentices (both of member and non-member firms). He said that the organizing committee had been both surprised and delighted by the response and entries had been received from no fewer than 38 patternmakers; 31 steel moulders; 27 iron moulders; 7 non-ferrous moulders. These entrants were employed by 21 different firms. Three prizes were to be awarded in each section and the twelve prizewinners will receive these at the annual general meeting to be held on April 2.

On February 12, the lecturer is to be Mr. G. L. Jones and his subject " Standardization in Gating Practice—Problems of Planned Application." A works visit has been arranged for March 11 to the new Lackenby works of Dorman Long & Company, Limited.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade, Export Services Branch, Room 801, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

ATHERTON (LANCS), February 15—Supply of iron castings, manhole covers, street gullies, etc., for the year ending March 31, 1955, for the Urban District Council. The Surveyor, Town Hall, Atherton, near Manchester.

ALDRIDGE (STAFFS), February 15—Supply of iron castings for the year ending March 31, 1955, for the Urban District Council. The Engineer and Surveyor, Daw End, Bashall, Walsall.

BARNSLEY (YORKS), February 15—Supply of cast-iron manhole covers and gully gratings, for the 12 months ending March 31, 1955, for the Borough Council. The Borough Engineer and Surveyor, Town Hall, Barnsley.

BEDLINGTON (NORTHUMBERLAND), February 22—Supply of iron castings for the 12 months ending March 31, 1955, for the Urban District Council. Mr. A. K. Dennis, engineer and surveyor, Council Offices, Bedlington.

FAILSWORTH (LANCS), February 8—Supply of cast-iron manhole covers and frames and gully grids, for the year ending March 31, 1955, for the Urban District Council. The Engineer and Surveyor, Town Hall, Failsworth, near Manchester.

HEYWOOD (LANCS), February 6—Supply of cast-iron manhole and ventilator covers, gullies, grids, etc., for the 12 months ending March 31, 1955, for the Borough Council. Mr. A. Middleton, borough engineer and surveyor, Municipal Buildings, Heywood.

LONDON, E.C.1, February 11—Supply of cast-iron and spun-iron straight pipes, cast-iron specials, mild-steel bars, plates, and sheets, bolts and nuts, screws, files, steel tubes, and small iron castings for the 12 months commencing April 1, 1954, for the Metropolitan Water Board. The Chief Engineer, Room 171, New River Head, Rosebery Avenue, London, E.C.1.

MACCLESFIELD (CHES), February 20—Supply of iron castings for the 12 months commencing April 1, 1954, for the Borough Council. Mr. J. H. Dossett, Borough Engineer, Town Hall, Macclesfield.

POOLE (DORSET), February 16—Supply of iron castings, manhole covers, etc., for the 12 months ending March 31, 1955, for the Borough Council. Mr. J. R. Barron, borough engineer and surveyor, Municipal Buildings, Poole.

STAFFORD, February 11—Supply of castings and ironwork, for the year ending March, 1955, for Staffordshire County Council. Mr. F. Jepson, county surveyor, County Buildings, Stafford.

URUGUAY, February 24—Lead, copper, tin, and other metal ingots, for the Administracion de Ferrocarriles del Estado. (ESB/1572/54.)

URUGUAY, March 9—Galvanized-iron piping, meter pumps, check valves, manhole covers, and accessories, for the Administracion Nacional de Combustibles, Alcohol y Portland. (ESB/1575/54.)

WARRINGTON, February 8—Supply of cast-iron manhole covers and frames, and gully gratings and frames for the 12 months ending March 31, 1955, for the Borough Council. The Borough Engineer and Surveyor, Town Hall, Warrington.

INDIA, February 12—Cast-steel railway wheels, for the Directorate General of Supplies and Disposals, Government of India. (ESB/1550/54.)

INDIA, February 15—Water-treatment plant, for the Government of Mysore Stores Purchase Committee. (ESB/1533/54.)

INDIA, February 17—Underground cable boxes, cast-iron type, complete with fittings and accessories, for the Government of Travancore-Cochin. (ESB/529/54.)

INDIA, February 18—Electric cables and cable boxes, for the Directorate General of Supplies and Disposals, Government of India. (ESB/1932/54.)

Non-ferrous Metal Industry in India

A symposium on "Non-ferrous Metal Industry in India" was held at the United Club auditorium, Jamshedpur, India, from February 1 to 3. It was opened by Dr. S. S. Bhatnagar, F.R.S., Director of Scientific and Industrial Research. The symposium has been organized with the object of focusing attention on the present state of non-ferrous metal industry in India and discussing ways and means for stimulating its growth to meet present and future requirements.

Engineers' Wages Inquiry

Final statements on behalf of both the unions and the employers were heard at the end of last month by the Court of Inquiry investigating the wages dispute in the engineering industry. The hearing was concluded and the report of the Court will be published in due course.

Sir Percy Mills, president of the Engineering and Allied Employers' National Federation, told the Court that current production of the engineering industry was generally much in excess of incoming orders so that a lower volume of turnover seemed inevitable. He said that an investigation covering over 54 per cent. of the employing power of the federation showed that total orders of these firms fell from £2,165,000,000 in the year ended May 31, 1951, to £2,074,000,000 the following year, and £1,560,800,000 at May 31 last. Export orders included in these totals had dropped from £648,400,000 in 1951 to £564,000,000 in 1952—a decrease of 13 per cent.—and to £449,700,000 a year later—a further decline of 20.27 per cent. Sir Percy pointed out that these figures related only to cash values of the orders and, as prices had risen over the period, the decreases in terms of physical units of production would be greater.

He said that they were "most apprehensive" as to the ability of the industry even to maintain its exports if wages and prices were increased.

Mr. Jack Tanner, chairman of the T.U.C., speaking on behalf of the unions, who spoke before Sir Percy Mills, said that the employers had sought to paint a rather gloomy picture of the industry's prospects. The export effort was being hampered, he said, by the shortage of sterling and the reluctance to grant long-term credits. He contended that the industry's output in October and November was above the 1952 level.

Mr. Tanner said that they did not consider that their wage claim would price our goods out of foreign markets even if the whole increase was passed on, which it need not be.

Board Changes

FERGUSSON, WILD & COMPANY, LIMITED—Mr. David L. McCardel has been appointed a director.

METROPOLITAN GAS METERS, LIMITED—Mr. Arthur Vivian B. Hughes has been appointed a director.

CONSTRUCTORS, LIMITED—Mr. John Macnish has been appointed to the board and elected chairman.

SILENTBLOC, LIMITED—Mr. B. H. Dulanty has been appointed chairman in succession to Mr. H. Vezey Strong.

SHORT BROS., LIMITED—Mr. Geoffrey Barkes has been appointed secretary in succession to the late Mr. Harold Stevens.

AMAL, LIMITED—Mr. G. S. Bellingham has resigned as chairman and from the board. The new chairman is Mr. J. M. Henderson.

Wiggin Nickel Alloys No. 24, issued from Henry Wiggin & Company, Limited, Thames House, Millbank, London, S.W.1, contains an illustrated description of a unique large-scale experiment in lining a reservoir with rubber. This should interest water supply authorities in particular and civil engineers in general. Other articles deal with Monel ragbolts, pipelines of uniform wall thickness, pickling chains, a machine for degreasing skins, marine chronometers and electrical instruments, the high-speed cutting of the Nimonic alloys and the production of oxy-insulated Brightray resistance wire.

Personal

MR. P. B. H. CUFF, chief buyer of the British A.B.O. Group, and purchasing director of the Brush Electrical Engineering Company Limited, Loughborough, has resigned.

MR. ALLAN SYKES, who has been assistant secretary since 1946, has been appointed secretary of the Cutlers' Company in succession to MR. J. H. WHITHAM, who recently retired.

MR. G. LLOYD JONES has been appointed manager of B.T.H. Cardiff district office to succeed MR. A. F. MACCARTHY, M.I.E.E., who is retiring from the British Thomson-Houston Company, Limited.

PROFESSOR ROBERT S. GREEN, chairman of the department of welding engineering at the Ohio State University, has been appointed executive director of the University's Engineering Experimental Station.

MR. ERIC L. MIDGLEY, a director of Midgley & Son, Limited, importers, exporters, and merchants of ferro-alloys, etc., of Sheffield, sailed last week on a business trip to South Africa and Rhodesia.

MR. S. DAVIS has been appointed works manager of the Backer Electric Company, Limited, Rotherham. Mr. Davis has been with the company since it started, and for a number of years has been works superintendent.

MR. GEORGE SALKELD has been appointed assistant to the production manager at the Hebburn-on-Tyne works of Baker Perkins, Limited, manufacturing engineers, iron, steel, and brass founders, etc., of Peterborough.

MR. N. R. REES, foundries general manager and works director of the Staveley Iron & Chemical Company, Limited, Chesterfield, is retiring this month after 18 years with the firm. Mr. Rees is an expert on centrifugal castings.

MR. T. H. SUMMERSON, chairman and joint managing director of Thomas Summerson & Sons, Limited, steelfounders and railway plant manufacturers of Darlington, has been elected president of the Tees-side Industrial Development Board.

MR. J. Y. SANGSTER, chairman of the Triumph Engineering Company, Limited, Coventry, was re-elected president of the British Cycle and Motor Cycle Manufacturers and Traders Union for 1954 at the annual general meeting in Birmingham on January 26.

MR. A. J. MILNE has resigned the managing directorships of Alumilite & Alzak, Limited, Mertone Metalcraft, Limited, Metal Chemical Treatments, Limited, and United Anodizing, Limited, and has joined Reginald Corfield, Limited, aluminium, tin, and paper printers, etc., of London, S.W.19.

MR. C. G. WHITE, general sales manager and a director of Kelvin & Hughes (Marine), Limited, navigational equipment makers, of London, E.C.3, has been elected chairman of the Radio Communication and Electronic Engineering Association for 1954. He has been vice-chairman for the past two years.

MR. A. J. W. BARTON, who was a director and manager of David Brown Tractors (Eire), Limited, since its inception in 1948, has handed over charge of the company to MR. J. B. EELES, on his appointment as general manager of David Brown (Australasia), Pty., following the death of Mr. P. J. Clifford.

PROFESSOR ALBERT PORTEVIN has been promoted to the grade of *Grand Officier* of the Legion of Honour. The Professor has been an honorary member of the Institute of British Foundrymen since 1934 and its members will wish to offer him warm congratulations upon his new distinction.

At a dinner at Stocksbridge recently, Mr. J. O'Dowd, Sheffield divisional organizer of the Iron and Steel Trades Confederation, presented a Confederation shield to MR. ERIC BRADWELL, chairman for nine years of Stocksbridge No. 5 branch, and a wallet and treasury notes to MR. J. DRABBLE, former branch secretary.

DR. J. W. ARMIT, who has been chairman of the Wilton Council of Imperial Chemical Industries, Limited, since 1946, has retired after 30 years with the group and its predecessors. While he was at Wilton, Dr. Armit served as president of the Tees-side Chamber of Commerce and was a member of the Tees Conservancy Commission. He is succeeded by MR. C. M. WRIGHT, director of the Billingham division.

MR. A. O. MILNE, who for seven years has been engineering manager of the dry docks department of Swan, Hunter & Wigham Richardson, Limited, shipbuilders, of Wallsend-on-Tyne, has been appointed deputy general manager of Harland & Wolff, Limited, at Liverpool. On behalf of 300 fitters in the department he has been presented with a silver platter. He will be succeeded at Wallsend by MR. G. H. TURNER.

SIR JAMES REID YOUNG has joined the Board of James Booth and Company Limited. Sir James is chairman of Vickers-Armstrongs Limited and several other companies. He is also managing director of Vickers and a director of a number of other companies. MR. A. P. WICKENS, chief engineer at the Ministry of Supply's Armament Design Establishment at Fort Halstead, is joining Vickers-Armstrongs, Limited, as manager of the industrial tractors section at the Scotswood works, on March 1. From that date he will also be a special director.

Obituary

MR. WILLIAM BROWN, who had been personnel manager at Euclid (Great Britain), Limited, Newhouse Industrial Estate, for the past three years, died suddenly last month at the early age of 35.

MR. JOSEPH CHARLES PITCHFORD, who died on January 26 at the age of 71, had more than 50 years' varied experience with leading engineering firms. After the first World War he joined Richard Lloyd & Company, Limited, Birmingham, becoming first a director and later managing director, while the firm was still at its Steelhouse Lane premises.

MR. EDWARD FRANKLYN ELLIOT died at his home in Bocking last Friday at the age of 86. Mr. Elliot was a co-founder of the firm of Lake & Elliot (founders and engineers), and took an active part in the affairs of the company until his retirement in 1948. He was born in Birmingham in 1868, son of the Rev. Henry Lettsom Elliot, who was later to become Vicar of Gosfield. Educated at Allhallows School, Honiton, Devon, Mr. Elliot served an apprenticeship at the Great Eastern Railway workshops at Stratford and later joined the engineering staff of Courtaulds, Limited, Bocking. In 1896, he entered into partnership with the late Mr. W. B. Lake, thus founding the firm bearing their names, and which became a limited company in 1910. Mr. Elliot remained on the Board until his retirement in 1948. In his younger days Mr. Elliot was an accomplished athlete and a notable performer in bicycle and tricycle racing; at one time he held the world record for the distance covered in 12 hours on a tricycle. For recreation, Mr. Elliot was particularly interested in fishing and shooting, making many trips to the Faroe Islands and to Norway.

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An important function of **F. & M. Ferro-Silicon Briquettes** is in the production of dense iron castings with high tensile strength. The foundryman usually ensures sufficient "softness" in his castings by using a pig iron with 3 to 4 per cent. Silicon. Such pig irons are frequently coarse-grained with large graphite flakes and, when used in ordinary cupola mixtures of pig and scrap iron, are apt to give rise to castings containing large graphitic flakes. This coarse-grained structure, which is particularly developed in the thicker parts of the section, results in an iron of comparatively low tensile strength.

By using pig irons of medium Silicon content (2 to 2·5 per cent. Silicon) which possess a denser structure owing to their smaller graphite flakes, and increasing the Silicon content of the metal by an appropriate addition of **F. & M. Ferro-Silicon Briquettes** to the cupola mixture, an iron with much smaller graphite flakes and, therefore, with a denser structure, is produced. At the same time, the metal is readily machineable, although it is denser and stronger, ***as the composition of the metal remains unaltered from that obtained by the use of higher Silicon coarse-grained pig irons.***

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News in Brief

SIXTY-SIX chargehands, staff and friends, attended a dinner, social and dance, of the Erewash Foundry, Stanton Ironworks & Company, Limited, which was held at the Club House, Stanton.

THE INTERNATIONAL HARVESTER COMPANY (OF GREAT BRITAIN), LIMITED, announce that Mr. David C. Harvey has been appointed director of sales. Mr. D. J. McIntosh is to be sales manager, with Mr. R. R. King as assistant.

GLOVER & MAIN, LIMITED, manufacturers of gas heating and cooking appliances, of London, S.W.1, announce a one-for-11 scrip issue capitalizing £49,500 of reserves. The new shares will rank for dividends declared after May 14.

THE MINISTRY OF MATERIALS has reduced its selling price for tungsten ores of standard 65 per cent. grade and ordinary quality as follows:— Wolframite, from 165s. to 145s.; scheelite, from 150s. to 140s., per ton delivered consumers' works.

THE COUNCIL of the British Cast Iron Research Association has scheduled the next Open Day, on which arrangements will be made for member-firms to send representatives to see the headquarters premises and work in progress, to be on Wednesday, July 7.

CAPPER PASS & SON, LIMITED, non-ferrous metals smelter and refiners, of Bristol, are cutting their interim dividend from 5 per cent. to 3 per cent., less tax, on the £813,750 ordinary capital, in respect of the year ending March 31, 1954. The total for 1952-53 was made up to 10 per cent., less tax, with a final of 5 per cent.

THE DIRECTORS of Bilston Foundries, Limited, have declared an interim dividend of 10 per cent. on the 2s. ordinary shares in respect of the year ending March 31, 1954, payable on March 1. This is the first occasion on which an interim dividend has been declared by the company. Last year one dividend of 20 per cent. was paid.

THE APPOINTMENT of Dr. W. Angus Macfarlane, of the Department of Scientific and Industrial Research and at present director of the U.K. scientific mission in North America, as general manager of the recently formed National Industrial Fuel Efficiency Service, was announced on Wednesday. Dr. Macfarlane will take up his duties with the N.I.F.E.S. in March.

PARSONS ENGINEERING COMPANY, LIMITED, Southampton, announce that for the year to October 31, 1953, a dividend of 10 per cent. is to be paid in comparison with 7½ per cent. for 1951-52 and with 5 per cent. for 1950-51. The last represented a resumption of dividends after a lapse of three years. Net profit has advanced to £14,073 from £10,971 in the previous year. General reserve is allotted £10,000 (nil), and there is no income-tax provision (£230).

THE LILLESHALL COMPANY, LIMITED, Oakengates, which is negotiating a £1,250,000 contract for structural steelwork and buildings in the Far East, has been successful in securing the first part of the contract totalling £350,000. A similar contract for the Far East totalling £500,000 was complete last year. Mr. A. Oxley, general manager, who has recently returned from Burma, states that the contract was secured against keen Continental competition.

H. M. HOBSON, LIMITED, manufacturers of aircraft engine components, of Wolverhampton, announce the maintenance of the year's payment at 20 per cent., a group profits increase of £189,025, and doubling of the £300,000 capital by a 100 per cent. scrip issue. The group's untaxed profits have expanded to £380,054, and the parent company's untaxed profit has risen from £180,743 to £285,367. The dividend is 17½ per cent., with a bonus of 2½ per cent., both as last year.

THE GENERAL ELECTRIC COMPANY, LIMITED, have introduced a new range of heavy weight (" H.W.") weatherproof switch fuses for use outdoors and in places where conditions are particularly rigorous. It will find applications in industries where considerable humidity is encountered. The new switch fuses comply fully with Home Office Factory Regulations, I.E.E. Regulations and the relevant British Standards. They are intended for circuits up to 500 volts and are available in 20-, 30-, 60- and 100-amp. sizes.

FROM the Port Colborne refinery, the International Nickel Company of Canada, Limited, have just made the first shipment of metallic nickel, under a contract calling for quick delivery of 54,000 tons of the metal to United States Government over a five-year period ending in 1958. Deliveries will be made at a monthly rate of 900 tons until the contract is completed. With an additional output of 10,700 tons annually, International Nickel's rate of nickel production is now approximately 123,000 tons per year.

FOLLOWING a decision reached in December, overtime and piecework will be banned in Welsh foundries and engineering works associated with the Welsh Engineers' and Founders' Conciliation Board as from February 15. Notice to this effect was given to the employers last week because of their refusal to grant the 15 per cent. increase in pay demanded by the Confederation of Shipbuilding and Engineering Unions. About 7,000 men employed in works from Port Talbot westwards are involved in the ban.

A FINAL DIVIDEND of 15 per cent., less tax, against 11 per cent. in the previous year, is announced by Wm. Asquith, Limited, machine-tool makers, of Halifax. With the paid interim of 5 per cent. and Coronation bonus of 5 per cent., total distribution for the year to October 1, 1953, is 25 per cent. against 15 per cent. Group net profit after tax of £270,850 (£196,150) is £137,711 (£103,654). In view of the recent acquisition of the £150,000 ordinary capital of Drummond Bros., Limited, Guildford, for which most of the consideration was provided from resources, the board has decided to seek Treasury consent to capitalize £225,000 of reserves by means of an issue of one ordinary share for each ordinary share held.

A RISE IN PROFIT is shown by the preliminary statement of Le Grand, Sutcliffe & Gell, Limited, well-drillers and oil-equipment makers, for the year to September 30 last, and a dividend of 10 per cent. is recommended on the ordinary capital as increased to £200,000 by a 50 per cent. free scrip issue followed by a one-for-three " rights " issue at par. The dividend compares with the 12½ per cent. annual rate on £100,000 since the company was made " Public " in 1948—equivalent to 6¼ per cent. on the present capital—and with a forecast of 8 per cent. by the directors at the time of the " rights " issue and £200,000 debenture placing last April. Profits before tax have expanded from £59,817 in the previous year to a peak figure of £72,142, struck after providing £5,775 gross debenture interest, and comparing with the estimate of not less than £70,000 made in April.

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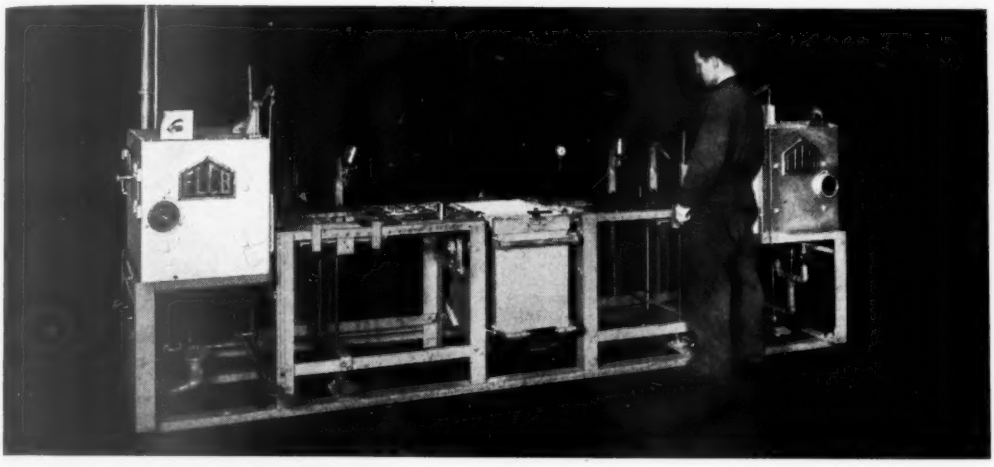

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⊗ 236/53

Pig-iron and Steel Production

Statistical Summary of November Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activity during the previous six months. Table II gives production of steel ingots and castings in November and Table III, deliveries of finished steel in October, 1953. Table IV gives the production of pig-iron and ferro-alloys in November, 1953, and furnaces in blast. (All figures weekly averages in thousands of tons.)

TABLE I.—*General Summary of Pig-iron and Steel Production.*

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.[1]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[1]
1951	284	170	206	186	175	8	301	244	585
1952[2]	306	190	228	202	171	29	310	252	739
1953—June[3]	301	202	238	211	188	14	338	263	914
July	281	197	229	202	153	19	277	223	958
August	273	203	226	204	159	19	291	211	1,046
September[4] ..	292	215	232	214	196	14	347	272	1,016
October	288	226	237	222	202	12	355	279	986
November	292	232	245	229	206	15	363	—	995

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in November*, 1953.

District.	Open-hearth Acid.	Open-hearth Basic.	Bessemer.	Electric.	All other.	Total Ingots.	Total Castings.	Total
Derby, Leics., Notts., Northants and Essex ..	—	3.4	9.7 (basic)	1.8	0.2	14.1	1.0	15.1
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.8	26.5	—	1.6	0.8	29.4	1.3	30.7
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	38.4	—	—	0.1	38.4	0.1	38.5
North-East Coast	1.9	68.4	—	1.3	0.5	70.1	2.0	72.1
Scotland	4.4	39.6	—	1.6	0.8	44.4	2.0	46.4
Staffs., Shrops., Worcs. and Warwick	—	17.3	—	1.3	0.6	17.4	1.8	19.2
S. Wales and Monmouthshire	5.2	71.8	5.7 (basic)	1.2	0.2	83.3	0.8	84.1
Sheffield (incl. small quantity in Manchester) ..	9.5	28.5	—	9.6	0.6	46.0	2.2	48.2
North-West Coast	0.1	2.5	5.5 (acid)	0.5	0.1	8.6	0.1	8.7
Total	22.9	296.4	20.9	18.9	3.9	351.7	11.3	363.0
October, 1953	22.5	292.2	17.4	19.0	3.9	343.6	11.4	355.0
November, 1952	25.4	273.5	22.5	20.0	3.8	333.5	11.7	345.2

TABLE III.—*Weekly Average Deliveries of New Non-alloy and Alloy Finished Steel.*

Product.	1951.	1952.[2]	1952. Oct.[4]	1953. Sept.[4]	1953. Oct.
Non-alloy steel;					
Ingots, blooms, billets and slabs[5]	4.0	4.5	4.8	4.8	5.4
Heavy rails, sleepers, etc. ..	10.1	9.8	8.8	10.4	11.6
Plates ¼ in. thick and over ..	41.0	41.4	45.2	47.8	49.1
Other heavy prod.	39.9	39.0	41.6	47.4	47.8
Light rolled prod.	46.7	46.0	51.3	49.1	51.4
Wire rods	15.9	15.9	17.8	15.1	16.7
Bright steel bars ..	6.5	6.5	7.2	7.0	6.9
Hot-rolled strip ..	19.5	18.8	21.6	19.8	20.2
Cold-rolled strip ..	6.0	6.1	6.2	5.5	5.8
Sheets, coated and uncoated ..	30.4	31.6	35.5	36.0	36.6
Tinplate, terneplate, and blackplate ..	13.8	16.0	16.9	16.9	17.9
Steel tubes, pipes ..	20.3	20.1	21.6	21.2	19.7
Tube and pipe fittings (excl. flanges)	0.5	0.4	0.4	0.3	0.4
Mild wire	11.6	12.2	13.3	11.0	11.5
Hard wire ..	3.5	3.6	3.9	3.5	4.2
Tyres, wheels, axles	3.7	3.5	3.8	5.0	4.7
Forgings (excl. drop forgings) ..	2.3	2.8	3.0	2.9	3.4
Steel castings ..	3.8	4.2	4.2	3.8	3.7
Tool and magnet steel	[8]	0.3	0.4	0.3	0.3
Total	279.5	282.7	307.5	307.8	317.3
Alloy steel	11.4	13.7	14.5	13.8	14.7
Total deliveries from U.K. prod.[6] ..	290.9	296.4	322.0	321.6	332.0
Add; Imported finished steel ..	5.8	13.8	13.0	6.3	4.6
	296.7	310.2	335.0	327.9	336.6
Deduct; Intra-industry conversion[7] ..	55.0	60.2	65.6	57.5	59.2
Total net. deliveries.	241.7	250.0	269.4	270.4	277.4

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys during November*, 1953.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	27	—	19.0	24.7	0.9	—	44.6
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire .. Yorkshire (incl. Sheffield, excl. N.E. Coast) ..	8	—	15.5	—	—	1.3	16.8
Lincolnshire ..	12	—	30.2	—	—	—	30.2
North-East Coast	25	4.7	49.1	0.7	—	1.3	55.8
Scotland	9	0.7	13.8	2.3	—	—	16.8
Staffs., Shrops., Worcs., and Warwicks ..	9	—	8.0	1.6	—	—	9.6
S. Wales and Monmouthshire	9	5.0	31.7	—	—	—	36.7
North-West Coast	8	16.7	—	0.2	—	1.1	18.0
Total ..	107	27.1	167.3	29.5	0.9	3.7	228.5
October, 1953 ..	106	27.0	161.1	28.6	0.8	4.0	221.5
November, 1952..	104	27.7	145.8	28.6	1.1	3.6	206.8

[1] Weekly average of calendar month.
[2] Stocks at the end of the years and months.
[3] Average 53 weeks ended January 3, 1953, all tables.
[4] Five weeks, all tables.
[5] Other than for conversion into any form of finished steel listed above
[6] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.
[7] Material for conversion into other products also listed in this table
[8] Included with alloy steel.

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Raw Material Markets

Iron and Steel

The further advance in steel production is imposing heavy demands upon blast-furnace capacity, and although the latest figures show that 107 furnaces are working, pig-iron supplies are still tight. Raw materials are not lacking. Imports of foreign ore are running at a record rate of nearly 950,000 tons per month, and coking capacity is at least keeping pace with blast furnace needs. But so heavy is the consumption of basic iron in the open-hearth steel plants that the starting of some of the new blast furnaces nearing completion is impatiently awaited, and in the meantime foreign iron is being imported in considerable quantities. Deliveries of hematite and low and medium phosphorus iron barely measure up to current requirements, and only specifications for common foundry iron can be readily satisfied.

Unless there is a sharp reversal of current trends, the steady shrinkage in the imports of steel semis seems likely to continue. Foreign plates are still arriving in considerable quantities, but British steelmakers can now provide the bulk of the semi-finished material required by the sheet and re-rolling mills and only small, marginal tonnages are still coming in from the Continent. Consumers, in fact, are so well supplied that defective material attracts little interest and prices are easier in consequence.

The position of the makers of finished steel products is still very strong. All the heavy rolling mills have an abundance of specifications, and although no decision has yet been reached on the subject of coal prices and railway rates, apprehensions of a rise have given a further impetus to the clamour for quick deliveries.

Plate supplies have improved, but the full requirements of shipbuilders, engineers, and boilermakers have not been overtaken and heavier demands are expected to accrue from railway-carriage and wagon builders. The outlook for the sheet trade has been fortified by the receipt of a substantial volume of export orders, and more inquiries are in circulation for heavy joists and sections. In fact, the only really disappointing feature is the depressed state of the market for light re-rolled products.

Non-ferrous Metals

Active conditions ruled on the Metal Exchange last week and on a day-to-day basis fluctuations were not inconsiderable, but actually a comparison between the range of closing prices last Friday afternoon and those ruling a week earlier did not show a great deal of change. The second three months period since the copper market was launched on August 5 last has now been completed and it is reasonable to assume that by now the standard contract has been thoroughly tested. Comments and complaints are heard about the way it is operating, but there is no word of any revision being made. On the other hand, it is understood that some comparatively minor changes are to be made in the lead contract in the near future. One of the troubles attaching to the copper market is, of course, the fact that stocks are too low for comfort, and, unfortunately, warehouse stocks are declining. This means that the backwardation remains and it is actually showing signs of increasing, the figure obtaining last Friday, for example, being £12 10s., or 30s. more than a week earlier. The Government broker is still operating in the ring, but there has been talk that before many weeks have passed he will be withdrawn. Confirmation of this is lacking at the moment, but obviously the present arrangement cannot go on indefinitely. No doubt a similar course will be adopted in copper as for zinc, where, it will be remembered, selling on Government account in the ring terminated at the end of July last, an announcement being made that some 60,000 tons would be sold through trade channels spread over many markets.

Price changes last week were slight, but for the most part downwards, the exception being zinc, which scored an advance of 5s. in the early position and a similar amount for forward, the backwardation remaining at 30s. No change was made in the U.S. quotation of 9½ cents, and lead also was unaltered at 13 cents. In London the lead market gained 5s. for the prompt position, thanks to some concentrated buying but lost 10s. forward, the backwardation widening to £1. Tin was very steady, losing £2 10s. for cash and closing unchanged forward. Copper closed only 10s. down for cash, but lost £2 for three months. Scrap prices are rather easier as a result of better supplies.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* January 28, £221 to £222; January 29, £222 10s. to £223 10s.; February 1, £221 10s. to £222 10s.; February 2, £225 10s. to £226 10s.; February 3, £227 10s. to £228.

Three Months: January 28, £208 10s. to £209; January 29, £209 10s. to £210; February 1, £210 10s. to £211; February 2, £213 10s. to £214 10s.; February 3, £214 5s. to £214 15s.

TIN, Standard—*Cash:* January 28, £643 to £645; January 29, £647 10s. to £650; February 1, £650 to £655; February 2, £650 to £655; February 3, £653 to £654.

Three Months: January 28, £627 10s. to £630; January 29, £628 to £630; February 1, £630 to £632 10s.; February 2, £632 10s. to £635; February 3, £632 10s. to £535.

ZINC—*January:* January 28, £72 10s. to £72 15s. *February:* January 29, £72 5s. to £72 15s.; February 1, £72 to £72 5s.; February 2, £72 to £72 5s.; February 3, £72 to £72 5s.

April: January 28, £70 10s. to £71. *May:* January 29, £70 15s. to £71; February 1, £70 10s. to £71; February 2, £70 10s. to £71; February 3, £70 10s. to £71.

LEAD—*January:* January 28, £83 10s. to £83 15s. *February:* January 29, £84 to £85; February 1, £84 15s. to £85 5s.; February 2, £85 to £85 5s.; February 3, £84 to £84 5s.

April: January 28, £83 to £83 10s. *May:* January 29, £83 5s. to £83 10s.; February 1, £83 5s. to £83 10s.; February 2, £83 10s. to £84; February 3, £83 to £83 5s.

Instrumentation for Industrial Health

The University of Michigan, through the Institute of Industrial Health and School of Public Health, is organizing from May 24 to 27 a "Symposium on Instrumentation." The programme will include exhibits, discussions, and technical papers on instrumentation in the following fields:—(1) Sampling and analysing air for contaminants in work places; (2) laboratory-type instruments for industrial hygiene; (3) atmosphere pollution evaluation; (4) measuring air velocity and metering air; (5) measuring sound and vibration; (6) measuring ionizing radiations; (7) measuring physical phenomena—light, etc., and (8) "home-assembled" instruments. For further information about the symposium, those interested should write to:—Director, Continued Education, School of Public Health, University of Michigan, Ann Arbor, Michigan.